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FLYING

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OCTOBER

50¢

WHAT YOU SHOULD KNOW ABOUT
AVIATION FUELS

AIR GUARD —
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TRAINING AT
FAA'S AERONAUTICAL CENTER

CESSNA 320
SKYKNIGHT

PILOT REPORTS:
CANADAIR'S SWING-TAIL CL-44
SHINN'S TWO-PLACE 2150-A
CESSNA'S TURBOSUPERCHARGED SKYKNIGHT

LIGHTWEIGHT FREE TURBINE:
ALLISON'S AWARD-WINNING T63

MOTOROLA'S NEW M-4:
AUTOMATIC FLIGHT CONTROL SYSTEM

Custom Service for Transients and "Non-Skeds" at Sioux City

Lowell Crabb, President. Pilot and veteran airport dealer who brought "good service to Sioux City."

Hangar and service ramp at Airways Service, Inc. . . . Sioux City Municipal Airport, Sergeant Bluff, Iowa. Flight office is at right.

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FLYING®

OCTOBER, 1961

VOLUME 69, NUMBER 4

COVER: Newest addition to its line of business aircraft is Cessna's 320 Skyknight, subject of the pilot report on page 38. Powered by a pair of fuel injection turbosupercharged Continental TSIO-470B engines, the 320 has a single-engine ceiling of 17,300 feet and a twin-engine ceiling of 27,200 ft.

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NEXT MONTH'S General Aviation annual will include key performance and specification tables, plus pictures, of U. S. and Canadian aircraft, powerplants, nav/com and support equipment now in production or about to be produced. Supporting articles point to a radically new market picture for aviation and the readers of FLYING.

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WINGS and THINGS

SIMPLIFIED TURBINE under development by General Electric is causing a stir among lightplane manufacturers. New type powerplant is a 400 to 500 shp turboprop/turboshaft which will embrace many stamped-out parts and other easy-to-manufacture assemblies. Primary objective: to make its sales price competitive with that of piston engines. First running of a complete engine reportedly is scheduled for next spring.

NEW LYCOMING ENGINE, *a development of the four-cylinder 180-hp 0-360, has fuel injection, produces 205 hp at 2,700 rpm. Five of the new powerplants have been built to date; three are being test flown prior to FAA certification. Among aircraft now flying with the 180-hp version, and considered likely candidates for the fuel-injected higher-power version, are the Lake L-4, Mooney Mark 21, Piper Comanche 180, Beech Travel Air.*

RESERVISTS WILL FLY, if so ordered. There has been conjecture as to whether a reservist, ordered to active duty with USAF, would be ordered to fly. In time of war, according to new Air Force regulations (numbered 60-1), any USAF member on active duty can be ordered to fly any type of aircraft. In time of peace, however, active duty airmen will be ordered to make official flights only when deemed in the best interest of the service.

NORTH AMERICAN'S T-39 SABRELINER, *twin-jet, six-eight place utility aircraft powered by two Pratt & Whitney JT-12s of 3,000-lb thrust each, expected to be granted FAA certification this month. Decision re commercial marketing will follow. The fast Sabreliner (see Pilot Report in Flying for July) cruises at 500 mph; range approximates 1,725 mi. USAF has ordered 94 of the aircraft, with cruise altitude above 40,000 ft.*

AIRCRAFT MERGER? Downer Aircraft (Alexandria, Minn.) producers of the Bellanca 260, and Hammond Aircraft (Oakland, Calif.), which turns out the Executive-twin Super-V, reportedly negotiating final details of merger which would find both aircraft produced under one roof. Site has not yet been decided.

CHEROKEE ON FLOATS *expected to be marketed by Piper in the spring of 1962. Aircraft is currently undergoing tests fitted with Edo Corp. (College Pt., N. Y.) floats Model 89-2000; the same floats utilized with the Piper PA-18. Each float has 2,000-lb displacement (that is, will support that much weight). With attachment gear, two floats, water rudder, weight of package is 243 pounds; cost is $2,828.*

LOCKHEED'S JETSTAR, four-engine compact military and corporate transport, has been granted FAA's transport certificate. Eight-passenger jet (plus crew of two) is powered by four Pratt & Whitney JT-12 powerplants of 3,000-lb thrust each. During certification, five JetStars flew more than 1,000 hours, prior to which two prototypes had flown over 1,300 hours. Tests included speeds ranging from 110 mph (landing) to 700 mph (dive).

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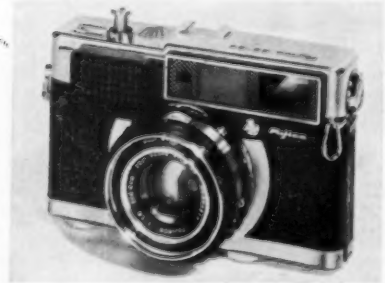

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MAILBOX

MOONEY'S POSITIVE COOLING SYSTEM

We here at Mooney wish to thank you for the very fine and factual flight report covering the new Mark 21 in your August issue. One small error, or misinterpretation, we wish to correct, however.

Mr. Schlaeger stated that the ground run-up time on the 180 hp Lycoming should be limited to two minutes in summer due to a tightly cowled engine. I wish to point out that the Mark 21's positive cooling system is one of the features of this new ship that is retained from the M-20A, which has proved out with over six years of use by over 800 Mooneys.

By positive cooling, the air is forced down through the cylinder fins and out the bottom of the cowl through the cowl flaps. The Mark 21 offers a bonus feature in the adjustable cowl flaps which regulate the amount of air passing through and over the engine without the speed penalty of a fixed bell type cowl and its high drag.

All modern engine manufacturers recommend a limited ground run-up time at low engine speed to preclude fouling spark plugs from the high octane fuel and its high lead content. This is not a cooling problem, however.

The fact is that all Mark 21's are run 30 minutes on the ground out of the factory in the hot Texas sun to break them in. Engine temperature remains well within the green on the cylinder temperature gauge which is standard equipment.

It is normal operation in the wintertime in the Northland with cowl flaps closed. Therefore, prolonged ground operation is not a cooling problem on a Mark 21, and this we guarantee.

D. E. BENEDICT

Mooney Sales Company
Kerrville, Texas.

TALENTS RECOGNIZED

I have noticed three articles by Jack LeBarron in the past few months in FLYING and it gratifies me that his many talents are being recognized by a commercial aviation magazine, as they have long been by the U. S. Navy.

I first met Mr. LeBarron in flight school in 1945; and since that time his accomplishments have never failed to astound those of us who know him.

He is an exceedingly able pilot, a real professional in all aspects of the flying field, both military and private, and his last article ("Prescription for Thunderstorms," June issue—ED) shows he can point up and explain to us ordinary airplane drivers such difficult subjects as aerology and its various vicissitudes in a manner that we can understand.

Each of his articles has been extremely well written and informative. We are looking forward to more of them.

ROBERT K. JONES

Pembury, Kent, England.
P.S. My qualifications: 4,000 plus hours. 23 types of aircraft from biplanes to jet fighters to transports. R. K. J.

● *See elsewhere in this issue "Clear Air Turbulence." Author: Jack LeBarron.*—ED.

JETPORT CRASH EQUIPMENT

In your excellent Check Pilot Report by A. C. Bass on the Kaman H-43B in the June issue of FLYING, I was pleased to see that some thought is at last being given to a mounting problem of the commercial jet age crash rescue.

In the article Mr. Bass states "with today's jet ports encompassing vast tracts of land, with approaches often inaccessible to ground vehicles, there exists a growing need to re-appraise the adequacy of rolling crash equipment!

"Time is the most important single factor in the event of a crash."

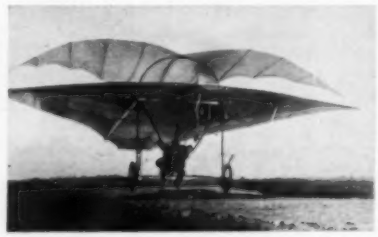
Recent incidents have more than proven this point. Now is the time for action.

CARL MACCRARY

New York, N. Y.

FLEXWING AIRCRAFT

I read with interest in the July issue of FLYING the article "Flexible Wing Lightplane" authored by J. S. Butz Jr. The photograph on page 22 showing Ryan's flexible wing craft struck a familiar note and sent me rummaging through my collection of FLYING magazines. Sure enough, in the June 1957 issue, on page 42, I found the



answer in the article "Unsung Pioneer." The photo on that page (see above) showed the Danish Ellehammer plane which bears a striking resemblance to the Ryan Flexwing craft.

An interesting point is that both Ellehammer and Rogallo, present inventor of the flexible wing principle, did considerable work with kites.

ED. DOWD

Long Island City, N. Y.

F-106 PERFORMANCE

Your August issue with the article by Richard Bach on "Air Defense and the F-106" is certain evidence of your growing coverage . . . An excellent article.

However, I am sure you will agree that the F-106 has a pitot boom and not a pilot boom. Mr. Bach stated that the F-106 idled at 60 per cent of engine power. This is not an exact statement. Engines of this type and of the type in the F-102 idle at such rpm, but it is not an indication of engine power. Engine power is determined by the relation of static pressure to turbine discharge pressure and not by rpm. The engine may develop 100 per cent power at only 92 per cent rpm.

Additionally, being an F-102 pilot, it is hard to imagine a F-106 with a landing of 3,000 feet under normal conditions, using drag chute, brakes and dragging your heels.

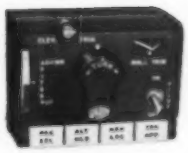
H. F. SIMPSON

Houston, Texas.

● *From Bach's reply: Thank you for your comments on the F-106 article; it was a good way to temper the shattering blow of*

(Continued on page 6)

Command Performance



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MAILBOX

(Continued from page 4)

being caught in such a slip as saying, "60 per cent of engine power." I . . . allowed my casual '60 per cent power' of conversation to be set down in black and white.

A pitot boom is a pitot boom, but to a printer it is a "pilot boom." In the same vein, "a steep attitude" becomes a "steep altitude" . . . Despite our best efforts such typos do get by.

I don't know if the '106 has the same brake system that the '102 has, but we certainly shuddered to a halt in the '106B. I didn't think that such a heavy machine could stop so quickly.

FIRST OUTSIDE LOOP

I am not sure now which issue of your wonderful magazine carried this statement about Bevo Howard and his Buecker Jungmeister—"He was the first to outside loop a lightplane; a 37 hp Piper Cub in 1938."—but I'm sure it's wrong because I was an eye-witness (to an outside looping demonstration) in 1930 at What Cheer Airport in Pawtucket, R. I.

I'm not sure how light is "light," but the Hess Argo (I think with a Warrior engine) was a small biplane (made, I believe, in Alliance, Ohio) and though the pilot's name escapes me, he did go storming around the country in 1930 or so, outside looping at air meets.

I don't bring this up as criticism, but just wonder if someone doesn't remember this little guy who went looping on the outside so long ago?

JOHN C. FULTON

Chestnut Hill, Mass.

P.S. Incidentally "What Cheer Airport" is now Narragansett Race Track, what a shame.

● *True. A Danish stunt pilot did fly an Alliance Argo in the 1930's on a stunting tour through the U. S. The airplane was not considered exactly a lightplane in those days. The engine developed 120 horsepower and the plane weighed 1,650 pounds.* —ED.

LOVE FIELD

I have enjoyed reading your fine magazine for many years and have, in fact, refrained from a subscription due to my extensive travels which now permit me to pick up your publication from the newsstands without waiting to return home to read it.

As a Dallas resident and a commercial traveler who flies from Love Field in Dallas both privately and commercially, I'm always interested in comments relative to the feud between Dallas and Fort Worth regarding the location of the airport each should use.

Thus, I'm afraid that outsiders from any source whatsoever simply do not appreciate the stand of Dallas in the matter of Love Field and any other field elsewhere for air service. We do not wish to deprive any other airport in any location of any traffic to which it is entitled. If Carter Field in Ft. Worth can support additional flights, it is welcome to them.

Also we do not appreciate outside writers and speakers—from Mr. Halaby on down to the recent letter from a Houston resident . . . making any comments which would tend to force Love Field "lovers" to go elsewhere with their business.

When Love Field doesn't pay off for Dallas and for the serving carriers, I'm willing to see it closed. Until then . . . !

R. E. NIXON

Dallas, Texas.

NORTH OF THE YUKON

Reference the letter from Atlantic City on "Modern Equipment" in July "Mailbox," we of the 1931-3 Communications Detachment not only dispute the writer's claim that it is the only airport in the U. S. that provides a "Chick Sales" for the convenience of operational Air Traffic Controllers, but add that ours is the northernmost "lounge" and contains such features as electric light and heater. . . . This building was constructed by former "Double A" GCA controllers and is now available to controllers of the New Air Force Communications Service. This detachment also operates a VHF Tower and provides the only Air Traffic Control Service north of the Yukon River.

We enjoy your magazine very much as it keeps us in contact with the latest aviation developments "outside."

CAPT. ROBERT C. ADKINS

Galena, Alaska.

OLD WILDCATS

Just out of curiosity, is that one of our old General Motors-built FM-1 or -2 (Grumman) Wildcats in the far left hand side of the "Big Day at Mayport" picture

on page 96 of the August FLYING? I didn't think there were any still in existence.

BRUCE ROBERTS

Ramsey, N. J.

● *At least one that we know of. Al Whitehouse, Jacksonville, Fla., converted a surplus Wildcat FM-2 (in photo) into a five-place airplane. Cabin with four seats was fitted into roomy fuselage. (Note side windows, one of which is covered with numbered placard).*—ED.

GOOD AIRPORT

I just finished reading the August issue of FLYING and enjoyed the article about Ramapo Valley Airport (old Spring Valley Airport, N. Y.). Every word author Jules Bergman said is true. The service you get there is great. I lived nearby the airport a few months last year and naturally spent every day there.

Rockland County needs airports like that of Spring Valley. . . . It is this kind of a field—through good service and friendliness—that makes out well.

CARY BRANDT

Amityville, L. I., N. Y.

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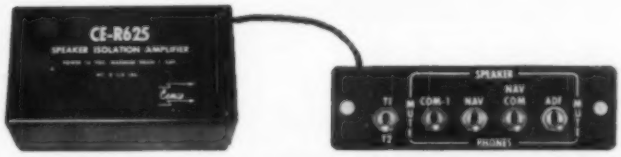

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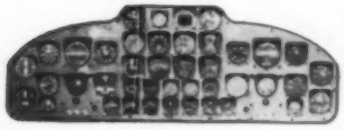

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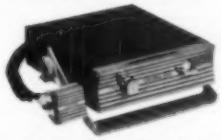


Communicate from plane-to-office or plane-to-home with Osborne all-transistor "Class D" citizens' band two-way radio. Model 300 (above) is 3.2 watts; comes complete with mike, crystals, and power cord. . . . . **$149.50.** (Portable models also available from **$99.50**)

4 USE AIR ASSOCIATES Seat Belts

These full-bodied nylon-rayon belts exceed FAA requirements. Air Associates has been making seat belts for over 30 years — the airlines choose them . . . they HAVE to be safe.

5 Protect Your Investment USE A NEW SEAVIEW T-HANGAR

Leased or purchased—no money down. Ferno baked white enamel on galvanized steel. Pre-fabricated, pre-painted. Handsome and rugged. Easily assembled, easily moved. Patent-applied-for, tab-lock construction. Engineered in Miami. Write Air Associates

6 USE BG Pioneer-Leader in Aircraft Spark Plugs

For a truly long-life spark plug ask for the BG platinum electrode spark plug . . . designed to the tradition of quality that has been BG's standard since 1917. For top-flight engine performance and time-tested reliability your best choice is BG.

Your airport operator or dealer has hundreds of additional products to make your flying easier, safer. Most of these products (including the six above) are supplied to him by

AIR ASSOCIATES INC.
TETERBORO, N.J.

Warehouses in: Atlanta, Georgia; Chicago, Illinois; Columbus, Ohio; Dallas, Texas; Denver, Colorado; Glendale, California; Kansas City, Kansas; Holman Field, St. Paul, Minnesota; Miami, Florida; San Francisco, California; Teterboro, New Jersey; Tulsa, Oklahoma; Wichita, Kansas; Wichita Airport, Kansas.

BRIEFINGS...

Rushed to forest fire duty in the West's worst season, a charter U. S. Forest Service Hiller E-4 helicopter shuttles three firefighters and equipment from a temporary heliport to an urgent hot spot in the Sequoia National Forest. Eleven helicopters

of various types were in use at one time during this "Campaign Fire," most of them flying six hours daily, the maximum allowable by the Forest Service. One of the nation's largest users of charter helicopters, the Service has just purchased its first rotorcraft—a Hiller E4.

Germany's twin-engine Donier Do 28 has been granted FAA certification. The Do 28, powered by two Lycoming 180 hp 0-360-A1A engines is a STOL-type four to six passenger airplane in which American buyers have shown interest. The manufacturer reports several orders from the U. S. are already on its books.

Standing in readiness to keep a guiding "eye" on the first U. S. Astronaut to hurtle into space is this Mercury Project Tower at Kano, Nigeria, an integral part of the globe-circling system of tracking stations established by NASA. The tower is pure 20th Century, but the local transportation

system is centuries old. Perched atop the tower is an "AGAVE" antenna—product of the Cubic Corp., San Diego, Calif.—that picks up voice and telemetry signals from the manned space capsule as it soars above the horizon; then automatically tracks it throughout each satellite pass.

Billed as the "world's most popular lightplane" a Cessna Skyhawk—deluxe version of the Cessna 172—is currently participating in a U. S. Information Agency Transportation Exhibition on tour in Russia until mid-January. Scheduled to visit Moscow, Stalingrad, and Odessa, remaining 21 days in each city, this special traveling exhibit is designed to show the Russian people how Americans travel. Also included in the show is a Ford Thunderbird, a Buick engine; large scale models of U. S. jet airliners and prominent U. S. ocean passenger and freight vessels.

Thirty-eight additional airports will be receiving new visual glide slope indicator lights in the near future. FAA has awarded a $247,922 contract to Sylvania Electric Products, Inc., Salem, Mass. for major components of the system. First delivery of the equipment is scheduled to begin immediately. Cost of a single installation ranges up to $47,000 depending in part on the lighting and electrical system already installed. Total cost of the 40 systems (two have already been installed at New York's LaGuardia airport) will be in the neighborhood of $1.6 million.

A new traffic control system designed to handle any kind of air traffic, including private aircraft as well as jet transports and military jet aircraft, has been developed under a USAF contract by Avco Corp.'s Electronics and Ordnance Division in Cincinnati, O. Now undergoing evaluation at FAA's Atlantic City, N. J. R&D Center (NAFEC) the system (named officially AN-GSN-11) is capable of directing 24 aircraft—18 inbound and six outbound—at the same time. All that is required is that the airplane have a radio so the pilot can receive his instructions from the system.

Granted official approval by the General Services Administration to take over the deactivated Naval Air Station at Opa Locka, the Dade County Port Authority, Miami, Fla., is now finalizing plans to make the facility into a top grade general aviation facility. Located a few miles north of Miami International Airport, Opa Locka has four paved runways, a large number of small buildings and four hangars.

Project SCAN began its third month of operation on September 1 and near-collision reports continued to come into SCAN headquarters by the hundreds, indicating—among other things—pilots' confidence in the program as handled by the Flight Safety Foundation. While the data accumulated to date do not suggest a definite pattern of near-collision incidents, certain

trends have been noted. For example the largest number of incidents reported thus far occurred near airports and at low altitudes. Trends of this type are being watched closely in consideration of possible pattern development. Photo shows Lincoln Stock, SCAN's technical manager and Pat Stevens, secretary, add the day's mail to that previously received.

Four Lockheed JetStars, among the first pure jets to enter the business aircraft market, are currently undergoing individualized exterior paint jobs and custom-designed interiors at the Garrett Corporation's AiResearch Aviation Service Division at Los Angeles International Airport.

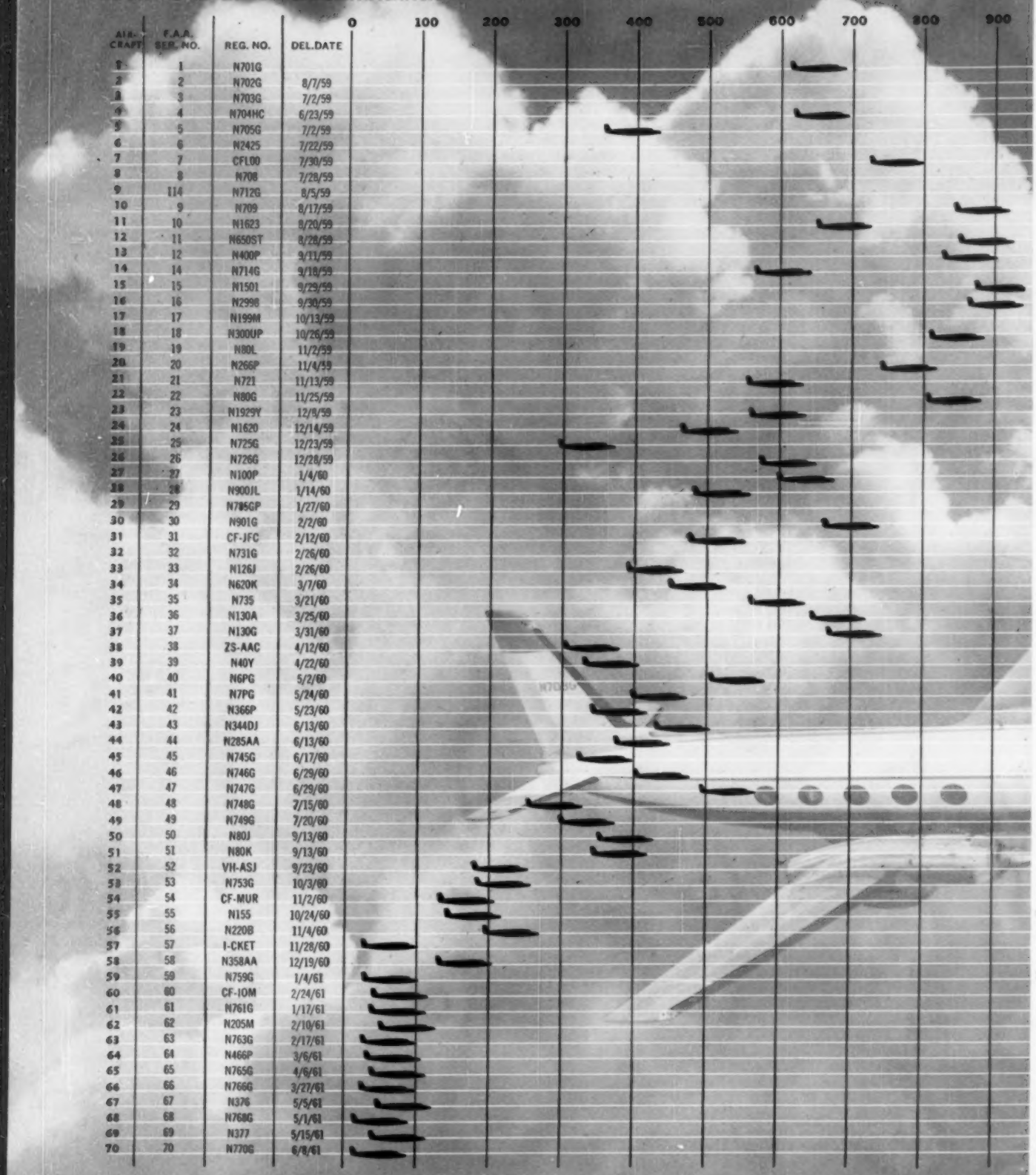
The figures speak for themselves. Concerned over the general public's fear of the "awesome and dreadful threat" of death from falling aircraft, Oscar Bakke, assistant administrator FAA's Eastern Region, instituted a search for the number of

(Continued on page 132)

OLD BIRD AND THE NEW GENERATION—Built in 1928 and still operating as a scheduled airliner, the Tin Goose (left) contrasts sharply with the new generation turbine-powered Grumman Gulfstream (right, foreground) and Allison turbo-prop Convair on the flight ramp at Pacific Airmotive's facility in Burbank, Calif. Up from Mexico for its first major overhaul in 12 continuous years of operation, this Tri-Motor Ford is but one of several of its breed still flying.

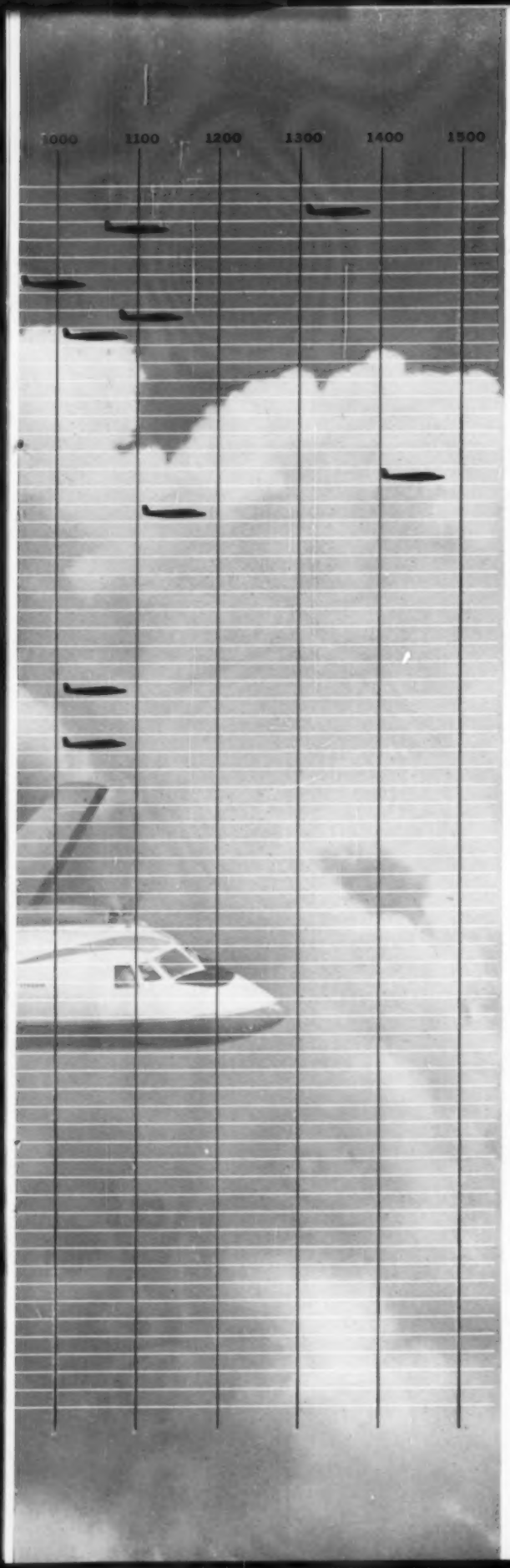
introducing... the triple "S"
The Collins 51Z-3 Marker Beacon Receiver is the first expression of a new concept in airborne electronics—*Solid State Systems*. Designed for airline and general aviation use, the 51Z-3 weighs only 2.9 pounds. It's about the size of a carton of cigarettes and requires no shockmounting. Size and weight are just two of the many advantages of the Solid State 51Z-3. A tough, scratch and chip resistant vinyl finish protects the case. A triple-tuned circuit automatically rejects interference from TV and FM signals which can cause false marker indication. The transistorized 51Z-3 requires only .2 amp for continuous operation and can be installed in any 27.5 or 13.75 volt system. Priced at $608.00*, the TSO'd 51Z-3 Marker Beacon Receiver is available from your Collins Distributor.
* U. S. A. List Price
COLLINS RADIO COMPANY—CEDAR RAPIDS • DALLAS • BURBANK • NEW YORK
COLLINS

FLYING HOURS SINCE F.A.A. CERTIFICATION.



AIR-CRAFT	F.A.A. SER. NO.	REG. NO.	DEL. DATE
1	1	N701G	
2	2	N702G	8/7/59
3	3	N703G	7/2/59
4	4	N704HC	6/23/59
5	5	N705G	7/2/59
6	6	N2425	7/22/59
7	7	CFLDO	7/30/59
8	8	N708	7/28/59
9	114	N712G	8/5/59
10	9	N709	8/17/59
11	10	N1623	8/20/59
12	11	N650ST	8/28/59
13	12	N400P	9/11/59
14	14	N714G	9/18/59
15	15	N1501	9/29/59
16	16	N2998	9/30/59
17	17	N199M	10/13/59
18	18	N300UP	10/26/59
19	19	N80L	11/2/59
20	20	N266P	11/4/59
21	21	N721	11/13/59
22	22	N80G	11/25/59
23	23	N1929Y	12/8/59
24	24	N1620	12/14/59
25	25	N725G	12/23/59
26	26	N726G	12/28/59
27	27	N100P	1/4/60
28	28	N900JL	1/14/60
29	29	N705GP	1/27/60
30	30	N901G	2/2/60
31	31	CF-JFC	2/12/60
32	32	N731G	2/26/60
33	33	N126J	2/26/60
34	34	N620K	3/7/60
35	35	N735	3/21/60
36	36	N130A	3/25/60
37	37	N130G	3/31/60
38	38	ZS-AAC	4/12/60
39	39	N40Y	4/22/60
40	40	N6PG	5/2/60
41	41	N7PG	5/24/60
42	42	N366P	5/23/60
43	43	N344DJ	6/13/60
44	44	N285AA	6/13/60
45	45	N745G	6/17/60
46	46	N746G	6/29/60
47	47	N747G	6/29/60
48	48	N748G	7/15/60
49	49	N749G	7/20/60
50	50	N80J	9/13/60
51	51	N80K	9/13/60
52	52	VH-ASJ	9/23/60
53	53	N753G	10/3/60
54	54	CF-MUR	11/2/60
55	55	N155	10/24/60
56	56	N220B	11/4/60
57	57	I-CKET	11/28/60
58	58	N358AA	12/19/60
59	59	N759G	1/4/61
60	60	CF-IOM	2/24/61
61	61	N761G	1/17/61
62	62	N205M	2/10/61
63	63	N763G	2/17/61
64	64	N466P	3/6/61
65	65	N765G	4/6/61
66	66	N766G	3/27/61
67	67	N376	5/5/61
68	68	N768G	5/1/61
69	69	N377	5/15/61
70	70	N770G	6/8/61

Shown above: actual recorded flight time on Gulfstream aircraft—May 1959 to July 1961.



Grumman Gulfstreams set outstanding utilization records! Fly 68 million passenger miles since May 1959

One Gulfstream, owned by George W. Crothers Limited, traveled 171,000 passenger miles in just one week!

68 million passenger miles! 35,000 flying hours! *All* in just 26 months, from F.A.A. certification in May 1959 to July 1961 . . . .

This is aircraft utilization at its best . . . aircraft utilization that only a Gulfstream can deliver. For it is the only aircraft in its class designed exclusively as a business airplane!

The result: the Gulfstream offers unique flight and ground flexibility. It's the most do-everything business airplane there is—one of the most useful *and* usable business airplanes in the world!

For a good example of this, just consider the experience of George W. Crothers Limited of Toronto, Ont. This company's Gulfstream traveled 171,000 passenger miles in just seven days!

Starting on a Sunday and for seven consecutive days on a daily basis—the Crothers' Gulfstream ran scheduled trips between Toronto and Tampa, Florida. The purpose of these trips was to airlift top Canadian customers to Tampa for demonstrations of a new line of tractors handled by Crothers Limited.

The seven-day Crothers flight log tells the Gulfstream utilization story with dramatic detail.

	DEPARTED	ARRIVED	DEPARTED	ARRIVED
Sunday	Toronto 07:57 Ft. Lauderdale 14:20	Tampa 12:04 Toronto 18:25	Tampa 12:42	Ft. Lauderdale 13:35
Monday	Toronto 08:10	Tampa 11:28	Tampa 13:08	Toronto 17:06
Tuesday	Toronto 08:24	Tampa 11:45	Tampa 12:47	Toronto 16:44
Wednesday	Toronto 07:52	Tampa 11:29	Tampa 12:50	Toronto 16:34
Thursday	Toronto 07:57	Tampa 11:42	Tampa 12:53	Toronto 16:27
Friday	Toronto 07:59	Tampa 12:25	Tampa 13:26	Toronto 16:52
Saturday	Toronto 07:34	Tampa 11:05	Tampa 12:37	Toronto 16:27

Flight performance like this—performance that makes the Gulfstream ideal for 71-mile or 7100-mile trips—is one reason why 70 Gulfstreams are now in operation. Other reasons are Gulfstream's proven safety, reliability, comfort and beauty. It's a sound investment.

Corporate executives and pilots may arrange for demonstration flights through the following distributors. In the United States: Atlantic Aviation, Wilmington, Del.; Pacific Airmotive, Santa Monica, Cal.; Southwest Airmotive, Dallas, Tex. In Canada: Timmins Aviation, Montreal. In Europe: Atlantic Aviation Export Corporation, London, England.

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AIRCRAFT ENGINEERING CORPORATION

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INTRODUCING THE NEW MOTOROLA M-4

THE FIRST MAJOR ADVANCE IN FLIGHT CONTROL FOR GENERAL AIRCRAFT IN OVER A DECADE

COMPLETE AUTOMATIC CONTROL FROM TAKE-OFF TO TOUCH-DOWN:

- AUTOMATIC 3-AXIS CONTROL
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- AUTOMATIC ILS APPROACH
- FLIGHT PATH INDICATION
- FLIGHT PATH MONITORING
- BACK COURSE APPROACHES

See your Motorola dealer for a flight demonstration or write us for full details.

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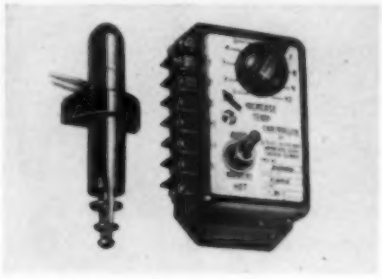
10916 W. Washington Blvd., Culver City, Calif.

NEW PRODUCTS

An automatic cabin temperature control system designed for twin-engine aircraft equipped with gasoline-fired combustion heaters is being marketed by the Vap-Air division, Vapor Heating Co., in Chicago. Called Skytemp, the 12-ounce kit consists of a controller (right) which is set to the



desired temperature and a Vap-Air Merc Thermostat (left) which senses the temperature. The unit has FAA parts manufacturer approval and supplemental type certificate for most twin-engine aircraft. VAP-Air bulletin D-690, gives full details. Address: 80 E. Jackson Blvd., Chicago 4.

Most recent addition to Aircraft Radio Corporation's Starflite II line is the RT 317A VHF nav. com system. Lightweight (13.7 pounds), the 317A transmits on 360 channels and receives on 380 channels. Transmission range is 118.00 to 135.95 mc in 50 kc steps. It receives VOR and localizer from 108.00 to 117.9 mc, plus 180 communications channels from 118.00 to 126.95 mc in 50 kc steps. It has own shock-mounting, separate receiver and transmitter controls; squench control. The transistorized DV-317A Dynaverter operates from a 14- or 28-volt dc power source, weighs 3.6 pounds; provides five-watt audio output for cabin speaker operation. An aural and three-light Marker Beacon Receiver is optional.

Dry vacuum pump kit for Cessna 172 aircraft is announced by Harms Industries, Inglewood, Calif. (P.O. Box 3246). FAA-approved for installation on this model, the unit installs on the factory standard 20A Delco Remy generator; increases generator

weight four pounds. A new type suction regulator and fittings are included in the kit which sells for $229. Approval of this installation for the Cessna 170 model is expected to follow immediately.

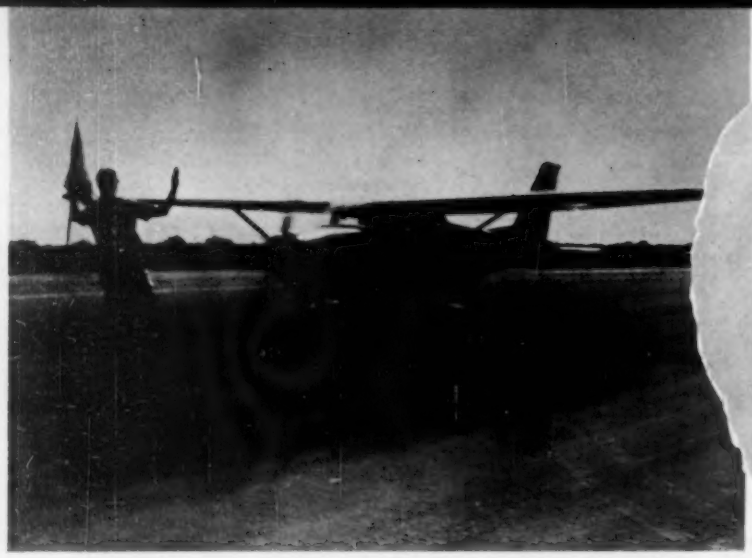
Now available from Stull Chemical Co., (P.O. Box 6386) San Antonio 9, Tex. is a completely new helicopter spray kit carrying an FAA Supplemental Type Certificate for installation on the Bell Models 47D, D-1, G, G-2, G-2A and G-3 'copters. The Stull kit consists of spray tank and spray boom assemblies; pumping and control system. When installed according to instructions furnished, the helicopter remains in a Standard Category according to the manufacturer. Application to fixed-wing aircraft is also possible, the firm states.

A cylindrical fire extinguisher, trade named "Merrimac," (right) is the latest development in Ansul Chemical Company's (Marinette, Wis.) product line. Identical in performance to Ansul's ball-shaped "Monitor" (left), the "Merrimac" contains two and three quarter pounds of dry chemical, and is rated 4 B:C by Underwriters' Laboratories. Feature of both models is the throwaway shell that, when emptied, is easily unscrewed and replaced with a spare. Trouble-free operation for five years is warranted by the company.

PanTronics Corporation of Fort Lauderdale, Fla. has added its second model—the Pan-Com DX10-R remote HF transceiver—to its line of high frequency aircraft transceivers. The DX10-R offers 10 crystal-controlled communications channels, ½ ATR case (¾ length), rugged shock-mount, heavy-duty built-in power supply, and like its companion PanCom DX10-D direct panel-mounted unit, features 50-watt transmitter output power. Weight of the DX10-R is 15 pounds; its price $1,245 for the 12-volt model.

First aid kits, packaged in steel or aluminum carrying cases, and especially designed for in-flight use may be obtained from A. E. Halperin Inc., 75-87 Northampton St., Boston 3, Mass. FAA-approved, the kits are available in three sizes to meet passenger requirements; in single engine, light and medium twin-engined aircraft and airliners.

Wing tip tanks, designed exclusively for the 1961 Piper Comanche—FAA-approved—are being marketed by Brittain Industries, Inc., 2352 W. Third St., Los Angeles 57, Calif. Of 15-gallon capacity each, the new Brittain tanks are said to boost useable fuel capacity to 90 gallons on 1961 Comanches (or a total of 120 gallons if aircraft is equipped with Piper's optional tanks) and to provide a gross weight increase up to 3,000 pounds for all PA-24-250s. Total weight of installation is 24 pounds; and complete kit sells for $995.



At the starting line! Dead ahead—2,700 miles of Mother Nature's unpredictable temperament and tricky topography . . .

"Powder Puff" Derby

A behind-scenes report on the 15th annual ALL-WOMAN TRANSCONTINENTAL AIR RACE . . . a unique, elapsed-time handicap, San Diego to Atlantic City, July 8-14 . . . sponsored by the NINETY-NINES, INC., international organization of women pilots

by HERB FISHER

international aviation authority, veteran test pilot, author

At the finish line, contestants Helen Guinn and Loretta Peacock of Houston, Texas, show Harry Archer, Champion Spark Plug Co. Aviation Div. Sales Manager, and Herb Fisher where they ran afoul of bad weather.

The dash to the time clock at Dallas, one of three "must" stops. In this elapsed-time handicap, *every minute counts!*

In a four-day (and night) period, 35 planes were readied for the race at Spider's Aircraft Service, San Diego—everything from replacing cylinders, fixing landing gear and general servicing to pulling an engine and replacing a crankshaft. F. W. "Spider" Schossow, a Champion "Stocking Dealer," tells Champion Representatives Earl Koehler and Tony Orgain how it was done.

FAA Administrator Najeeb E. Halaby is main speaker at the Awards Banquet in Atlantic City; Herb Shriner (right) emceed.

Pilots from Italy, Australia and South Korea are brought together in evening gowns at Awards Banquet . . . (l/r) Grazia Sertori, Rome; Nancy Bird Walton, New South Wales; and Kyung O. Kim, only woman fighter pilot in the South Korean Air Force.

Ocean-to-ocean is still one whale of a trip—if you're racing VFR in light aircraft, 90 to 250 hp! *Pilot and plane are put to real tests of capability.* Yet 2,700 miles later, on the ground, the lady flier will glance affectionately at her plane and say, "Nothing to it with Ol' Reliable here . . ."

The trip is a kaleidoscope of operational extremes, radically changing flying conditions. There are the high, thin, turbulent mountain altitudes. The soggy lowlands, the soupy seaboard uplands. Hot, dry, engine-abrasive deserts. Endless stretches. And wastrel winds that pay little heed to a lady flier's wooing.

You are on your own up there. The homemaker with four youngsters . . . the ATR veteran of World War II ferry service . . . the young school teacher . . . the lady from a foreign land . . . the astronaut aspirant . . . the secretary . . . the socialite. *One hundred planes.* Planes "begged," borrowed, rented, sponsor-donated, owned. Piloted and co-piloted by women with broad interests, deep

(Advertisement)

convictions, dedication—*but individualists all.* Individualists wedded to aviation by a not uncommon denominator in America: courageous *love* of Free Skies . . .

You are special. Yet you are not "superwomen." Sometimes your operational environment seems pretty hostile . . . and you may know moments of—well, call it *uncertainty.* The feeling may be triggered by scattered storm clouds that suddenly gang up to force you down, or turn you back, or ground you for two days. (As was the case at Jackson and Montgomery, where 90 planes were socked in while race deadline was extended an unprecedented 48 hours.) You may be bugged by headwinds—or a dozen other frustrations—and find that the Fates have fouled your race time with a flourish. You may despair. *But you go on.* Then again, you may log good time between refueling stops—and feel that your perseverance and pistons are teamed to put you among the winners . . . so long as shrewd female judgment continues outwitting Ol' Man Weather . . .

In the end, yours may be the heartache of many months of preparation flung to the four winds by fickle Fortune. *Or,* yours may be the joy of coveted trophies, a share of the $2,500 purse, and international recognition. But *whichever* it is, you agree on one thing: *You had fun epitomizing free and progressive aviation in a free and progressive land . . .*

* * *

These are the women and these are the demands of the world's only All-Woman Transcontinental Air Race. A time and place where women from all walks of life exemplify the virtues of an aviation industry made great through the products of American free enterprise . . .

All planes—Beeches, Cessnas, Pipers—were taxed to the utmost during this 2,700-mile marathon. Their engine performance is mute tribute to manufacturer . . . pilot . . . maintenance crew. The *majority* of engines were fired by Champion spark plugs—and the confidence these pilots had in their choice of so vital an engine component was justified many times over. Believe me, some of the gals really "fire-walled" their engines at times! *Champions delivered foul-free, full-firing power—without exception—throughout this long, engine-straining haul.* The majority of winning planes were fired by dependable Champions.

A salute, then, to the great gals of the NINETY-NINES, INC., international organization of women pilots whose officers and committees worked with fervor behind-scenes to *make* the highly involved "Powder Puff Derby" the whopping *success* it is!

CHAMPION SPARK PLUG COMPANY • TOLEDO 1, OHIO

Herb Fisher greets (l/r) Ruth Stafford, Raytown, Mo., and Pilot Sarah Lee Gorelick, Kansas City, Kansas, at finish line.

THIS YEAR'S WINNERS

FIRST —Frances S. Bera, Long Beach; Bonanza E-35; ATR; 10,000 hrs.; has won 5 times.

SECOND—Aileen Saunders, El Cajon, Calif.; Cessna 172; 1,400 hrs.; has won twice. Co-pilot, **June R. Douglas,** West Palm Beach, Fla.

THIRD —Irene Leverton, No. Hollywood, Calif.; Morrisey 2150; 8,200 hrs. Co-pilot, **Teckla Kaufman,** Pacific Palisades, Calif.

FOURTH—Frances Miller, Columbia, S.C.; Comanche PA-24; ATR; 6,500 hrs.; placed second in 1960. Co-pilot, **Sylvia Roth,** Glencoe, Ill.; ATR.

FIFTH —Pauline Glasson, Corpus Christi, Tex.; Cessna 175; 10,000 hrs.; has placed 5 times. Co-pilot, **Lena Jackson,** Corpus Christi.

International Officers of the 99s—Sponsors of the AWTAR

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Youngest and oldest two gals in the race . . . Co-pilot Jemmie Carol Hall, 16, of Detroit (standing with her pilot, Louise Hyde, New York, New York), and Co-pilot Viola Gentry, East Hampton, New York, (with pilot Shirley Marshall, Tucson). Viola soloed in 1925, was the first pilot to fly under both the Manhattan and Brooklyn Bridges.

(*Advertisement*)

IT'S CURTAINS IN 1½ MINUTES!

Flying above 18,000 feet you must have oxygen or lose consciousness in minutes depending on your physical condition. At altitudes between 10,000 and 18,000 feet your field of vision narrows. In fact, the armed forces require all flyers to breathe oxygen when flying above 10,000 feet in daylight or above 5,000 feet at night.

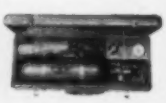
And yet, high altitude flight opens up a whole new standard of flying. It's comfortable . . . smooth. Up where the air is thinner you get better speed and longer range. Engine performance improves. You can avoid bad weather by flying higher where the sky is clear and blue. That is, you can if you have the proper oxygen equipment.

Take time to learn more about the physiology of flying. The operating altitudes of private aircraft have steadily increased. They are no longer limited to altitudes below 10,000 feet as most of them were in the past. Present trends to higher flight altitudes will continue. In the next ten years we can expect service ceilings in the neighborhood of 30,000 feet.

Unless suitable oxygen equipment is in the aircraft and convenient for use, we face the increasing possibility that such planes may at times be flown by pilots whose mental and physical capabilities have deteriorated. This could result from prolonged exposure to altitudes above 10,000 feet or by short exposure to altitudes still higher.

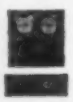
Today, oxygen equipment is so light-weight and inexpensive there is no reason for a flyer to deny himself the advantages of high altitude flight. If you would like to fly the high road and are interested in the types of oxygen equipment available, a letter to Regis Stevenson, Scott Aviation Corporation, Lancaster, New York, will bring you complete information.

HERE'S FLYING PLEASURE and BREATHING SAFETY



Scott Aviox. Portable Oxygen equipment for four. Leather case.

Scott Oxygen Console. Serves 5 persons.



Scott "President" Oxygen Installation kit. Serves from 1 to 5 persons.

Scott "Executive" Oxygen System. For 1 to 2 persons.

SCOTT AVIATION CORP.
LANCASTER, NEW YORK

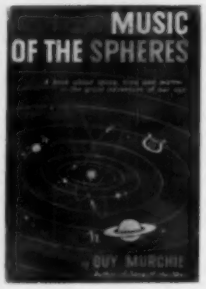
HAVE YOU READ?

By JAMES F. SUNDERMAN

MUSIC OF THE SPHERES, by Guy Murchie (Houghton Mifflin, 2 Park St., Boston, 7, Mass., $6.95).

Guy Murchie, onetime airman, offers here a journey into space, time and matter that is not unlike his 1954 best-selling exploration of the atmosphere—SONG OF THE SKY.

Indeed, this book is proper and timely, for the basic nature of the cosmos, like that of the air, rests on the physical sciences. And the airman-soon-to-be-spaceman will find a need to know the most fundamental principles of this discipline, and of the men whose work led up to the state of the art today. This is what Murchie does. He blankets his subject with imaginative, vivid prose, ranging from the inner structure and behavior of the atom to the farthest galaxy known, and back again to such weary things as scientific measurements, sound waves, gravity, oceanography, radiation and a score more topics. He views the world, above, below and around us from an imaginative space station and probes it with inviting, intriguing combination of philosophy and science, tying fact and interpretation to the stars, to the constellations, and the infinite void beyond where man will soon travel.



For a breathtaking trip through the chemistry and matter of the universe, this one will inform, teach, and entertain.

MODERN AIRMANSHIP, edited by B/G Neil D. Van Sickle, USAF (Van Nostrand 120 Alexander St., Princeton, N. J., $9.75).

When first published in 1953 this comprehensive airman's "bible" was rated among flyers as the basic text-reference-reader for professional and amateur alike.

Now it is out in revised, updated edition to include the advances in air technology during the past half-decade. New materials feature modernization in general aviation; jet air transport; hypersonic flight; current airways and air communications; and the FAA today. Topics such as flight theory, structure and propulsion, instruments and radio navigation, equipment and flight techniques reflect the latest known fact. Chapter revision throughout continues to make this one a complete reference for answers to a multiplicity of airmanship problems.

AIR FORCE COMBAT UNITS OF WORLD WAR II, edited by Dr. Mauer Mauer (Government Printing Office, Washington, D. C., $2.50).

A must for the reference library of aviation writers, historians and former AF members, this authoritative work features unit histories of all AF combat groups (bombardment, fighter, reconnaissance, and troop carrier), Wings, Divisions, Commands, and Air Forces that served overseas and in the U. S. during WW II. Each organization is traced from its origin to January 1956, thus presenting complete historical coverage; each unit is covered by photo of insignia, and data on lineage, operations, assignments, type aircraft, components, stations, commanders, campaigns, and decorations.

TESTING TIME: THE STORY OF BRITISH TEST PILOTS AND THEIR AIRCRAFT, by Constance Babington-Smith (Harper, 49 E. 33rd St., New York 16, N. Y., $4.00).

Although the British got off to a slow start in powered flight (it took a transplanted American—Texas-born Samuel Cody—to make the first one in England in October, 1908), they have been leaders in advanced civil and military aircraft design and construction, especially so in jet craft.

Miss Babington-Smith here traces British test flight from the days even before Cody's historic flight, with the experiments of John William Dunne on the D.3 (scaled down glider) and later the D.4, an under-carriageless contraption harnessed to the pilot who made the takeoff by running. She continues the detailed historical narrative of the men, the craft, the test techniques and epic events from then to supersonic jet operations today.

FOKKER—THE MAN AND THE AIRCRAFT, compiled and written by Henri Hegener, edited by Bruce Robertson (Harleyford, $8.50, sole distributors in U. S. are Aero Publishers, 2162 Sunset Blvd., Los Angeles, 26, Calif.).

Youthful Anthony Fokker, the Dutch aeronautical genius employed by the Germans, almost turned the tide of WW I with his invention of the synchronized machine gun in 1915. He went on to become one of aviation's outstanding designer-builders of a variety of military and civilian aircraft and few are the early airmen who have not flown one of his products.

Here, in this definitive biography of the man and the aircraft which bear his name, is the complete story. Divided into three parts, the first covers Fokker's life from early childhood to present in a 65,000 word narrative. The second contains 48 three-view, 1/72 scale drawings with specifications of Fokker aircraft—17 on double page spreads. Part three is a detailed study of 200 Fokker aircraft designs, illustrated by individual photos and supplemented with captions.

If you have trouble securing books reviewed here, send payment in check or money order to AEROSPACE BOOK CLUB, 7801 Old Georgetown Road, Washington 14, D. C. Your book will be sent postpaid.

NEW CESSNA TWIN SKYKNIGHT

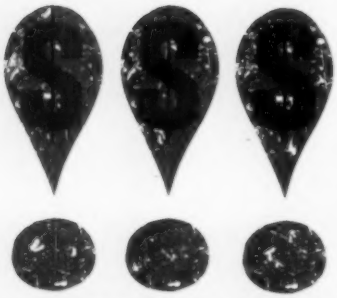
TURBOCHARGED POWER

for greater take-off and single engine safety at high altitudes

★★★ *spacious, comfortable, fast* ★★★

speeds up to 265 mph / fly over 5 miles up over the weather / 3 miles up on one engine

MOST VALUE PER MILE



OFFERING PREFERRED

DIVIDENDS FROM THE WORLD'S WISEST TRANSPORTATION INVESTMENT: THE SKYKNIGHT

This is the Skyknight. It's an all-metal, easy-to-fly, five-place executive twin-engine aircraft. It's the first executive twin to be equipped with turbocharged power . . . a notable extension of more than two decades of advanced research and development on twin-engine aircraft design by Cessna. As an incomparably safe, economical, comfortable, useful, and swift method of business travel and transport, it offers preferred dividends on your investment. It's the top of the Cessna line, designed to provide new dimensions to your flight plans . . . both in altitude and range.

It's a product of the most experienced team in the business aviation industry — a team that builds and sells the world's widest selection of mission-minded aircraft. And because Cessna's real business is designing and producing extra travel dividends, the Skyknight provides the world's wisest transportation investment.

Said more simply, the Skyknight will return more range, speed, comfort, and overall performance for every dollar you invest . . . than any other executive twin-engine aircraft available today!

So will all other Cessna's when matched with their competition. Ask any Cessna user.

From this source you'll find — as they have found — that every dollar used in designing and building a Cessna has been wisely spent to add the right combination of features which will benefit the user most. And this primary protection of user investments is bolstered by Cessna's inter-global service organization — all of which means that the Cessna dollars in your transportation budget will go farther and take you along.

Let's take a look at the new turbocharged twin and review all the reasons why you can expect — and get — a big, continuing return on your Skyknight investment.

★★★★★

Needlenose spi

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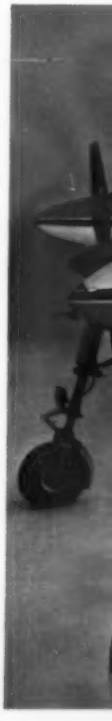
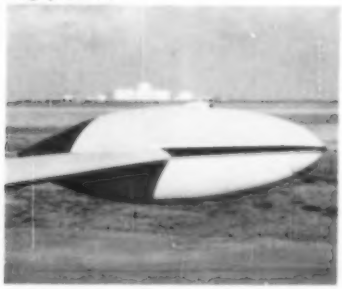


lenose spinner

Recessed navigation light



Wing-tip fuel tank

Flush riveting

Aerodynamically clean styling

CERTIFIED CESSNA-CLEAN... A GUARANTEE OF AERODYNAMIC EXCELLENCE

First of all, let's take an overall view. The long sweep and clean-lined simplicity you see is part of a practical and proven Cessna aerodynamic design philosophy which simply states... "Take out the drag" and Cessna does.

Over the years Cessna designers have patiently, persistently "sculptured" away awkward shapes, ridges, and bumps of all kinds to come up with the cleanest, most efficient design — The flight/sweep concept. You see it here again in the Skyknight.

Now... take another look at the long view of Cessna jet-age styling — the fuselage nose cap, needlenose propeller spinners, wing-tip tanks, the flight/sweep nacelles mounted parallel with the dihedral of the wing... and mentally project the entire aircraft into a single space capsule shape... and see how neatly the Skyknight fits into your mental picture of how an airplane should look!

This is only part of the story. Move in closer. Run your eye and hand over the all but invisible seams of one of the wing-tip tanks. See how designers have teamed with craftsmen to set a top standard of aerodynamic cleanliness... right down to flush riveting and fully recessed navigation lights.

Now stand at the fuel tip tank and look over the 175 square feet of wing area. Where you're standing is obviously the safest place for the main fuel supply — near the engines and farthest from the cabin and passengers. And since the tanks are squarely on the center of gravity, you won't have to re-trim the airplane as fuel is consumed. The evenness of weight distribution all along the wing also insures maximum flight stability. But your biggest gain comes in aerodynamic efficiency. The end result of Skyknight tank design prevents loss of lift at the wing tips. So much so that they actually provide the equivalent of the lift you would gain from an extra yard of wing span.

Notice also the flush riveting on the wing (allowing easy installation of light weight de-icer boots) — and everywhere else that matters. This is Cessna Craftsmanship; Cessna's concern for perfection at work for you.

This means, too, that the Skyknight is put together to stand long wear... that its smooth, clean fuselage, wing, and tail construction is tough, tight, good looking, and quiet.

The handsome all-over paint combination you see is one of ten available. And all ten are ruggedly resistant to weather and corrosion.

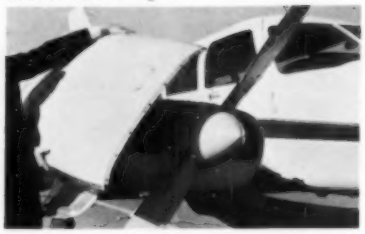
Think ahead. What you see is years ahead. And Cessna care in selecting quality materials, in designing and in building the Skyknight will protect your investment for the years ahead. As a result, you'll get top performance, low-cost maintenance and a solid trade-in when the time comes.

Now let's look at what makes it go... go... go!

Easy service access

Constant-speed propeller

Quick-removable cowling



TWIN TURBOCHARGED THRUST TOPS THE WEATHER!

Two-fisted Skyknight power comes in small packages. So small, in fact that the unusually flat nacelles are only 22½ inches deep at the thickest point. Notice how they blend into the wing so smoothly that they actually add to lift while creating an absolute minimum of drag.

A step away you can check the needle-pointed spinner which protects the constant-speed propeller mechanism. While you're there, check the ground clearance of the 80-inch propeller . . . a full 12½ inches to prevent tip damage.

Now unbutton the cowling. (Incidentally, a coin will substitute for a screwdriver.) You won't need a ladder to look into the waist-high power package. And you can reach any part of the engine or accessories through the quickly removable cowl and nose cap or through side access doors that fold down in a matter of seconds, leaving the engine exposed . . . a convenience factor which means easy inspection and faster, lower cost maintenance.

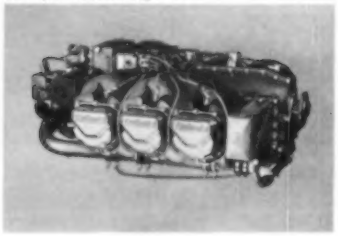
Now take a good look at the heart of the Skyknight story. Two hundred and sixty eager horses from each of two fuel injected Continental service proved engines. The important thing to remember is that each engine provides full 260 hp (520 total hp) performance at any altitude up to and including 16,000 feet . . . for each engine is equipped with a Turbocharger . . . the mechanism which takes in outside air, whirls it through a blower, and packs it into an engine at a rate which provides 260 hp at these high altitudes. It squeezes the thin air, found at 16,000 feet into the same density as normal sea level air, which provides greater take-off and single-engine safety at the

Smoothly faired nacelles

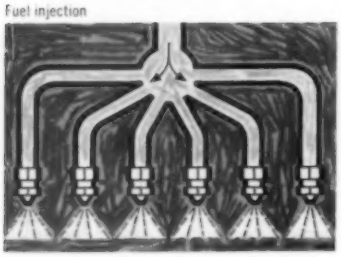
Exhaust Discharge Below Wing

Streamlined nose cap and nose wheel well

260-h. p. Continental engines



Fuel injection



majority of the world's airports — and every airport in North America! It delivers full rated horsepower from sea level up to 16,000 feet and a service ceiling of 27,200 feet on both engines, 17,300 feet on one engine.

This means that you can fully utilize the commanding range of your Skyknight — half a continent in half a day — all year around — truly a wise transportation investment.

Now, scan the engine room closely. Stainless steel stacks and tubes feed exhaust gases to the Turbocharger. Its fully automatic control provides maximum compressor output at high altitude. And each engine is equipped with fuel injection to meter the precise amount of fuel to each cylinder at all times to provide smooth engine operation, to eliminate hot cylinders, and to increase engine life and reduce engine maintenance.

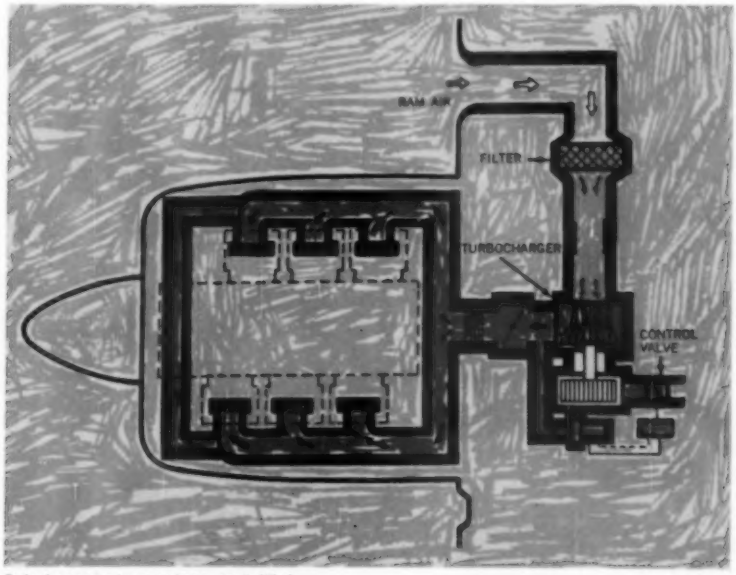
What can you get out of this new power package? Let's translate it into actual performance. The aerodynamically clean design of the Skyknight, coupled with the low ratio of weight to horsepower of 9.6 pounds per horsepower permits speeds up to 265 mph. It climbs on two engines at 1,850 feet per minute ... and for additional performance, a single-engine minimum control speed of only 88 mph.

On take-off, acceleration to safe single-engine speed is measurable in seconds, the Skyknight can clear a fifty-foot obstacle in only 1,470 feet. Sum total? New dimensions of "go whenever, wherever" travel freedom ... in your fast-climbing, high-flying Skyknight. Twin Turbocharged. Fuel injected. Ready for any mission you have in mind. Any time.

PACESETTING ... PRACTICAL ... PROVEN.

In keeping with over four-miles-per-minute speed, the Skyknight nose is smooth as glass and shaped like a projectile. It retains this streamlined smoothness in cruising flight ... because all wheel doors close flush with the exterior, sealing the complete gear inside the wheel wells. You'd never guess that this compact nose (with air intake) encloses so much useable space. But, looking up through the nose wheel well, you can see how much room there is for the heater, oxygen tank, radios, and other equipment ... and how easily these items can be reached for labor-saving servicing. A steel bulkhead seals off the nose compartment from the main cabin area ... for strength, silent comfort, and total safety. The pitot head and auto-

Turbocharger



Turbocharger: maximum engine power at altitude

Steerable nose wheel and taxi light

Dual cylinder brakes

Retractable landing lights

Split-type flaps

Flight / sweep tail

matic minimum speed indicator are electrically heated to prevent icing. The nose gear provides 15 degrees of steering action, and then swivels on command for tight taxiing turns. Its taxiing light turns with the nose wheel, always lighting the track ahead. Its mud guard protects against mud, slush, and ice accumulation.

Pneumatic-hydraulic struts on all three wheels provide cushioned travel to protect the Skyknight and its passengers from landing shocks. The Cessna-built gear is designed to withstand more than 14 tons of ultimate stress... more than five times the Skyknight's gross weight. The high-capacity, dual-cylinder, disc-type brakes are built to absorb over 585,000 foot pounds of kinetic energy... to give you safe stopping power more than ample for any emergency. The heavy-duty tires are six-ply for extra safety... and tubeless for weight saving and highest shock absorbing qualities. A service-proved electric motor-driven mechanism swiftly extends or retracts the landing gear. In keeping with Skyknight design for "two of everything that counts," the pilot can also easily extend the landing gear manually, using a hand crank located beside his seat. The landing lights retract flush into the wing... and give more useful light when extended than other types walled behind plexiglas.

You'll like the look of the Skyknight's generously sized, split-type flaps... you'll like their action even better. Electrically extended or retracted in seconds, they will hold their setting at any angle the pilot may select. You get quick lift over obstacles for short takeoffs... swift, easy descents into short fields... making Skyknight home bases out of almost any airport in the world. You'll like the easy feel and ready response of velvet touch ailerons, with adjustable-in-flight trim tab as a standard item. Also note that exhaust gases are discharged below the wing... insuring that the quiet-conditioned Skyknight cabin will remain quiet under all circumstances.

Step back to the Skyknight tail group and size up the handsomest stern in the sky. And there's more than beauty to its flight/sweep design. There's aerodynamic efficiency that gives you the easiest, fullest control and the smoothest ride of any twin-engine aircraft... under any and all operating conditions. Using either engine, or both, at any flying speed, you get superb horizontal stability and vertical control from a stabilizer-elevator combination that spans nearly 17 feet... and a combination which uses the full slipstream from both engines to boost control effects. Of course, the tail group movable controls are fully balanced. And you get airline-type trim tabs on both rudder and elevator. All the "extras" you need are here, too... rotating beacons and omni radio antennae, (faired smoothly into place)... safety tail skid... and just step forward and you'll see the vent which automatically removes stale cabin air... in flight.

Versatile seating arrangements

standard 4 or 5 place reclining | individual 4 place | individual 5 place | 5 place lounge

Ease of entry

Head Rests

Magazine and map pockets

Overhead Console

Reclining seats

Premium cabin and flight visibility

CONFERENCE ROOM-I-NESS AN EXCLUSIVE CESSNA COMFORT CONCEPT

Let's go inside. Notice how the retractable step is right in place for your use when you open the big "walk in, walk out" door. From the exterior, you would expect the interior to be big. It is... as you can see.

Here is a spacious, functionally planned conference room with room to spare to move around... change seats in flight... stretch out comfortably... raise up without bumping your head... room to work, room to relax. All this, and color-coordinated, eye-pleasing, prestige-packed, tasteful luxury.

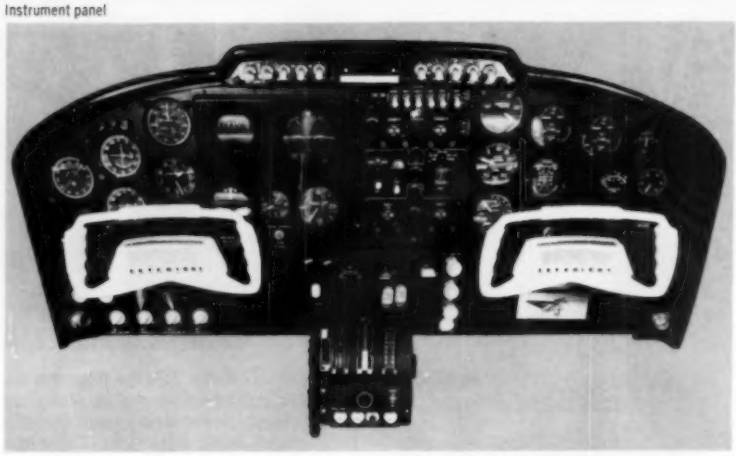
No "off-the-shelf" standardization limits you in your tastes. You choose from 4 possible combinations of seating arrangements and 4 color schemes... making your selections from the finest fabrics and genuine leathers.

Add up the many features in this spacious cabin. Seats that slide fore and aft... seat backs that recline individually... head rests and arm rests. Four big, sound-absorbing windows on each side. Windshield is aerodynamically designed so that even the heaviest rain instantly vanishes leaving clear forward vision. Individual airliner-type ventilators, ash trays, cigarette lighters, assist straps, coat hooks. Magazine and map pockets, three dome lights, cabin radio speaker, sun visors, curtains, hat and package shelf. An overhead console contains the Cessna oxygen system with five outlets and two auxiliary lighting systems. The "Comfort-Conditioner System" heats, ventilates, and defrosts, giving wide range of comfort control at all altitudes, Thermostatically controlled 35,000-Btu "Blend-Temp" heating system that attains full output in 15 seconds. Three cabin door locks for triple safety in flight. And a luggage compartment fully lined with genuine leather... big enough to let each passenger take ample luggage for extended trips. All these items... perfectly in place, perfectly planned for your greatest convenience, comfort, and confidence.

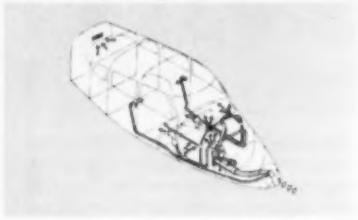
Gold - all leather

Luggage compartment

Instrument panel



Comfort controlled heating and ventilation



Ease into the pilot's seat. Study the instrument, control, and radio lineup. Here is the closest approach yet devised to perfection . . . the happiest blending of form and function, of "eyes-on-the-road" instrumentation and control, to be found in any aircraft . . . executive or airline, commercial or military. And night lighting is the best obtainable . . . featuring post lights for each instrument, four zones of light, each rheostatically controlled.

Notice how the controls and instruments are grouped according to their natural functions and sequences of operation. You don't chase all over the cockpit flipping this lever, turning that handle, and trying to scan instruments and dials here, there, and everywhere, right when you're busiest . . . on take-offs and landings. You simply do what comes naturally . . . moving from one close-together group of controls to another, step by step . . . and easily scanning the well-grouped instruments that matter, while you fly the Skyknight with your "eyes on the road" where they should be.

Cover the whole panel point by point, instrument by instrument, control by control. You'll find the same intensely thoughtful, careful planning applied everywhere . . . for maximum safety, convenience, comfort, utility. As far as possible, the Skyknight carries out your routines for you. You simply do what comes naturally . . . apply your own judgment, your experience . . . and this airplane responds as you wish . . . as it should . . . as it will.

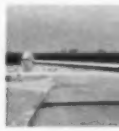
Now you're ready to fly. To see for yourself.

TRUE TURBOCHARGED TWIN SAFETY

Topaz fabric and leather

INTERIOR SELECTIONS

Sea Mist fabric and leather
Topaz fabric and leather
Champagne fabric and leather
Gold all leather (opt.)
Sea Mist all leather (opt.)
Topaz all leather (opt.)
Champagne all leather (opt.)



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EXTERIO

Platinum Blue (392)

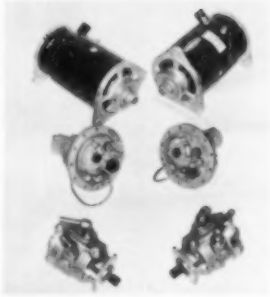
Turquoise Tinge (393)

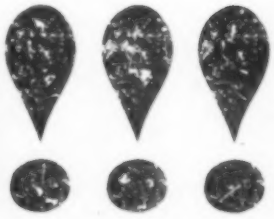
Nose Deck
Wings and
Center Strip

fore we start the engines, here's oint to remember. Turbocharged wer means EXTRA performce . . . "EXTRA" performance es you a margin for safety, and fety can be converted to "easiest fly." That's one of the reasons the yknight is . . . the easiest twin to .

so remember that true twingine safety is more than a matter two engines. The Cessna Skyight, fully loaded, climbs at the e of 400 feet per minute on one gine, and has a single-engine rvice ceiling of 17,300 feet. In e Skyknight, safety is carried en further than exceptional gle-engine performance. Here we ve two of everything that unts — two generators, two vacu- pumps, two vacuum systems, o engine-driven fuel pumps, cked by two auxiliary electric el pumps, and completely dual ition system on each engine. d to this structural integrity far ceeding that built into our modn commercial airliners and aeronamically clean flight/sweep sign . . . and you have the kind safety you deserve . . . the kind u get in the Skyknight!

Generators
Auxiliary Fuel Pumps
Vacuum Pumps





ERIOR COLORS

Vestal White (170)
Muted Beige (399)
Burgundy Metallic (386)
ue (392)
Mint Green (412)
Citron Yellow (344)
Intrinsic Orange (396)
Montmorenci Red (387)
nge (393)
Regal Green Metallic (390)
Tahoe Blue Metallic (394)
Ginger (389)
Deep Mahogany (285)

	#40	#41	#42	#43	#44	#45	#46	#47	#48	#49
Nose Deck and Cabin Top	399	396	170	344	170	170	399	170	170	170
Wings and Bottom	387	170	396	170	399	399	389	412	392	393
Center Stripe	285	285	285	285	389	386	285	390	394	390

AN INVITATION

This has been an introductory report on the Skyknight. A fast, far-ranging, five-place executive model twin aircraft. Twin Turbocharged 260-hp Continental fuel-injection engines make it capable of flying at altitudes of more than 27,000 feet to span half a continent in half a day, non-stop. Its outstanding short-field performance provides incomparable travel mobility and utility. Its cabin is luxurious, large, and quiet. In terms of aerodynamic design, it's clean as a pin. In terms of engineering integrity, it's unmatchable Cessna. The Skyknight has a definite place in the life of someone moving fast, ranging far. Are you that person? The place to find out is in the air where the eager surge of Skyknight power devours the miles in swift and silky smooth swallows . . . where you can sense the steady responsiveness of the controls . . . while you relax in the luxury of a comfort-conditioned cabin. The place to find out is in a Skyknight. To start . . . turn the switch (just like in your car) the battery-supplied "shower-of-sparks" ignition system will put a new spark in your travel future.

FIRST STEP

We're confident that after your demonstration flight you will see the wisdom of investing your flying future in a Skyknight. Which leaves the matter of "How?" This is as simple and clean as the Skyknight itself.

First, let your Cessna Dealer analyze your travel requirements. You'll find him an unusually skilled, understanding and well-equipped transportation analyst. His primary objective is to help you capitalize on the best transportation investment by matching one of many arrangements for putting a Cessna to work for you with your own business circumstances.

The basis for his planning is an exciting and thoroughly proven analysis called VPM (Value Per Mile). Composed of six simple questions, VPM will determine the dollars and cents story of your transportation needs, the amount of investment required, the operating costs, and the dividends you can count on.

He'll also acquaint you with available (and very liberal) Cessna financing plans . . . and work with you and your accountant to effect maximum tax savings, to plan the best overall purchase or lease arrangement, and to prove the profitability of putting yourself on top of present travel and transportation problems. In short, he'll fit together a plan to put you in a Skyknight from a rather amazing number of purchase, lease, and group ownership opportunities.

And for all of this . . . you, as a salesman, know there's no obligation. Just another Cessna service . . . provided by your Cessna Dealer . . . the man in whom you can invest your confidence . . . the man you should see . . . today!

SPECIFICATIONS

WEIGHT	4,350 lbs.
SPEED: BEST POWER MIXTURE	
Maximum — 16,000 ft.	270 mph
Maximum Recommended Cruise, 75% Power at 19,500 ft.	249 mph
Maximum Recommended Cruise, 75% Power at 10,000 ft.	228 mph
RANGE: NORMAL LEAN MIXTURE	
Maximum Recommended Cruise, 75% Power at 19,500 ft. 100 Gallons, No Reserve	864 miles
Maximum Recommended Cruise, 75% Power at 10,000 ft. 100 Gallons, No Reserve	794 miles
Maximum Recommended Cruise, 75% Power at 19,500 ft. 130 Gallons, No Reserve	1,136 miles
Maximum Recommended Cruise, 75% Power at 10,000 ft. 130 Gallons, No Reserve	1,035 miles
Maximum Range at 25,000 ft. 100 Gallons, No Reserve	1,184 miles
Maximum Range at 10,000 ft. 100 Gallons, No Reserve	1,090 miles
Maximum Range at 25,000 ft. 130 Gallons, No Reserve	1,537 miles
Maximum Range at 10,000 ft. 130 Gallons, No Reserve	1,415 miles
RATE OF CLIMB AT SEA LEVEL:	
Twin Engine	2,250 fpm
Single Engine	620 fpm
SERVICE CEILING:	
Twin Engine	28,700 feet
Single Engine	20,800 feet
TAKE-OFF:	
Ground Run	635 feet
Total Distance Over 50-Foot Obstacle	1,195 feet
LANDING:	
Landing Roll	590 feet
Total Distance Over 50-Foot Obstacle	1,650 feet
EMPTY WEIGHT (Approximate)	3,190 lbs.
BAGGAGE	200 lbs.
WING LOADING: Pounds Per Square Foot	24.1 lbs.
POWER LOADING: Pounds/HP	8.1 lbs.
FUEL CAPACITY: Total	
Standard	102 gals.
Optional	133 gals.
OIL CAPACITY: Total	6.5 gals.
POWER: Two Continental 6-Cylinder, Fuel Injection TSIO-470-B Engines, 260 Rated HP at 2,625 RPM	
PROPELLER: Constant Speed, Full-Feathering	
WING SPAN	36 feet
WING AREA	175 sq. ft
LENGTH	29.5 feet
HEIGHT	10.3 feet

NOTE: Single-Engine Service Ceiling Increases over 550 feet each 30 minutes of flight.

4,350 lbs. take-people, full gas plus 163 lbs. b optional equip

STANDARD EQUIPMENT

- Altimeter, Sensitive
- Ammeter
- Arm Rests, (Seven)
- Ash Trays, (Four)
- Attachment Provisions (Cargo Rings and Shoulder Harness)
- Batteries, (Two) 12 Volt
- Brake, Parking
- Brakes, Hydraulic Toe-Operated
- Carpet, (Wall to Wall)
- Circuit Breakers, Electrical
- Clock
- Compass, Magnetic (Variable Intensity Light Control)
- Control, Automatic Manifold
- Controls, Mixture
- Curtains, Window (Aft Three Windows)
- Cushions, "Polycloud" Seat
- Defroster, Windshield
- Detector, Navigation Light
- Door, Baggage Compartment Outside
- Engines, Fuel Injection Turbocharged
- Filters, Full Flow Oil (Two)
- Filters, Induction Air
- Flaps, Engine Cowl
- Flaps, Wing (Electric)
- Flasher Unit, Navigation Lights
- Floorboards, Removable
- Fuel System, Injection Type (Dual)
- Fuel Tanks, Wing Tip
- Fuel Valves, Quick Drain (Four)
- Gage, Fuel Flow (Dual)
- Gage, Outside Air Temperature (Electric)
- Gage, Suction
- Gage Units, Engine (Two) (Oil Temperature, Oil Pressure and Cylinder Head Temperature Gage
- Gages, Manifold Pressure (Dual)
- Generators, 25 Amp, 28 Volt
- Ground Service Plug Receptacle
- Gyros, Horizon and Directional New (One-Year Warranty — Includes Vacuum System)
- Headphone Jacks, (Two)
- Headrests, (Two)
- Heating System, Stall Warning Transmitter and Pitot
- Heating System, Stewart-Warner Cabin (Thermostatically Controlled)
- Hooks, Clothes Hanger (Two)
- Ignition System, Dual Operated
- Indicator, Airspeed
- Indicator, Fuel Quantity (Dual)
- Indicator, Landing Gear Warning Audible
- Indicator, Rate-of-Climb
- Indicator, Stall Warning Audible
- Indicator, Turn and Bank
- Indicator, Wing Flaps Position
- Instrument Panel, Shock-Mounted
- Landing Gear, Retractable (Electrica with Auxiliary Manual Extension)

Standard Equipment and Specifications Subject to Change Without Notice.

4,350 lbs.	4,650 lbs.	4,990 lbs.
270 mph	268 mph	265 mph
249 mph	247 mph	245 mph
228 mph	226 mph	223 mph
864 miles/3.5 hrs./247 mph	860 miles/3.5 hrs./244 mph	855 miles/3.5 hrs./242 mph
794 miles/3.5 hrs./225 mph	792 miles/3.5 hrs./223 mph	790 miles/3.5 hrs./221 mph
,136 miles/4.6 hrs./247 mph	1,122 miles/4.6 hrs./244 mph	1,110 miles/4.6 hrs./242 mph
,035 miles/4.6 hrs./225 mph	1,030 miles/4.6 hrs./223 mph	1,025 miles/4.6 hrs./221 mph
,184 miles/6.0 hrs./199 mph	1,144 miles/5.6 hrs./203 mph	1,100 miles/5.3 hrs./207 mph
,090 miles/6.7 hrs./163 mph	1,055 miles/6.4 hrs./165 mph	1,015 miles/5.9 hrs./171 mph
,537 miles/7.7 hrs./199 mph	1,487 miles/7.3 hrs./203 mph	1,430 miles/6.9 hrs./207 mph
,415 miles/8.7 hrs./163 mph	1,371 miles/8.3 hrs./165 mph	1,320 miles/7.7 hrs./171 mph
,250 fpm	2,050 fpm	1,850 fpm
620 fpm	520 fpm	400 fpm
,700 feet	28,000 feet	27,200 feet
,800 feet	19,500 feet	17,300 feet
635 feet	730 feet	870 feet
,195 feet	1,320 feet	1,470 feet
590 feet	620 feet	640 feet
,650 feet	1,725 feet	1,770 feet
,190 lbs.	3,190 lbs.	3,190 lbs.
200 lbs.	200 lbs.	200 lbs.
24.1 lbs.	26.4 lbs.	28.5 lbs.
8.1 lbs.	8.3 lbs.	9.6 lbs.
102 gals.	102 gals.	102 gals.
133 gals.	133 gals.	133 gals.
6.5 gals.	6.5 gals.	6.5 gals.
36 feet	36 feet	36 feet
175 sq. ft.	175 sq. ft.	175 sq. ft.
29.5 feet	29.5 feet	29.5 feet
10.3 feet	10.3 feet	10.3 feet
50 lbs. take-off allows for 2 ople, full gas and oil load, s 163 lbs. baggage and ional equipment.	4,650 lbs. take-off allows for 4 people, full gas and oil load, plus 123 lbs. baggage and optional equipment.	4,990 lbs. take-off allows for 5 people, full gas and oil load, plus 293 lbs. baggage and optional equipment.

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Notice.

Light, Fuel Selector Handles (Variable Intensity)
Light, Landing (Retractable, Left Wing)
Light, Taxi
Light, Turn and Bank Indicator Test (With Dual Circuit for Heater Overheat Indicator)
Lighters, Cigarette (Front and Back)
Lights, Dome (Three)
Lights, Instrument Panel White and Red Flood (Variable Intensity)
Lights, Instrument Post-Type Red (3 Zones, Variable Intensity)
Lights, Landing Gear Position
Lights, Navigation
Lights, Rotating Beacon (Two)
Lock, Baggage Door
Lock, Cabin Door
Lock, Aileron and Elevator Controls
Lock, Engine Controls Friction
Map Compartment
Microphone Jack
Nose Gear, Steerable
Oil Coolers, Non-Congealing
Oxygen System, Less Bottle
Paint Scheme, All-Over
Pockets, Map and Storage
Priming System, Engine
Propellers, Constant Speed Full Feathering
Pumps, Engine-Driven Fuel (Two)
Pumps, Engine-Driven Vacuum (Two)
Pumps, Electric Auxiliary Fuel (Two)
Regulators, Voltage (25-Amp, 28-Volt)
Rings, Airplane Tie-Down
Seats, Two Individual Reclining Rear (Usable as 3 Place)
Seat Springs, No-Sag
Seats, Adjustable Fore and Aft and Tilting Front
Shelf, Utility
Shielding, Engine Ignition
Sound Proofing (Super)
Space, Optional Instruments
Speaker, Cabin Radio
Spinners, Propeller
Starters, Engine (With Five-Position Rotary Switch)
Step, Retractable Cabin
Strainers, Fuel (With Quick Drain)
Straps, Assist (Two)
Sun Visors, (Two)
Tachometer, (Dual Electric)
Test Valve, Vacuum
Tow Bar, Airplane
Trim System, Aileron, Elevators, and Rudder
Tube Turbine Exhaust
Vacuum System, Engine-Driven Pump Type (Dual)
Ventilators, Adjustable Cabin Air
Window, Pilot's Hinged
Windows, Double (Aft Three Windows)
Windows, Tinted Side

WHAT'S YOUR NEED? / NAME YOUR CESSNA!

THINK DOWN THE (SKY) ROAD YOU CAN GET FRIENDLY, QUALIFIED CESSNA SERVICE FROM PORTLAND TO PARIS SINGAPORE TO SAO PAULO

FREE VPM ANALYSIS — With the answers to six simple questions, your Cessna dealer can provide a Value Per Mile Analysis for your company. You can actually see how little it costs to travel farther and faster in your choice of 13 Cessna's for '62 and how much extra power, performance, and progress you can expect and get. Ask your Cessna dealer for a free VPM analysis. No obligation.

FINANCING — Your choice of 13 new Cessna's for '62 are as easy to buy as they are to fly! Now your Cessna dealer offers a convenient, practical, and extra liberal plan for financing . . . a program designed to provide fast, simple, pre-planned financing service. See your Cessna dealer for the details and new terms of a financing plan which will put you out front, keep you out front — to stay — in a Cessna for '62. Lease plans are also available.

RENT-A-PLANE — If you want to test the profit-proven benefits of a Cessna before you buy . . . if you're looking for the link to make an important travel connection . . . or if you simply want to fly for fun . . . remember, you can rent a plane just like you rent a car! Fly yourself . . . or with pilot provided. Call your Cessna dealer for complete details.

COOPERATIVE OWNERSHIP — If your individual needs do not presently justify sole ownership of of the Cessna of your choice, ask your Cessna dealer about group ownership. He'll give you the full details of the popular associate plan for cooperative airplane ownership . . . a practical plan which permits small groups to pool their private air travel budgets in order to economically participate in the progress — and fun — of flying a Cessna for '62!

LEARN TO FLY AS YOU TRAVEL — Your Cessna dealer has a flight training plan to fit your every-day schedule. Most popular is the "Learn to fly as you travel" plan. You can actually take "on-the-job" flight training during business trips! Your Cessna dealer can also arrange an "after five" and weekend schedule of training, too. And when you solo, your Cessna dealer will present you with a "Cessna Solo Trophy," a clever and handsome piece you'll be proud to put on permanent display in your trophy case, at home, or in the office!

"GOLDEN RULE" INTERGLOBAL SALES AND SERVICE — Wherever you go you'll be only minutes away from the Cessna "Golden Rule" service. When you see the Cessna dealer's red and blue pennant shield of service — it's a sure sign that your service needs will be handled expertly, economically, and efficiently by factory-trained service technicians . . . and that you'll get prompt, courteous attention. Across the nation . . . around the world . . . look for the red and blue pennants, the sign of Cessna Golden Rule Service!

Cessna®
AIRCRAFT COMPANY
WICHITA / KANSAS

WHO and WHERE

Joseph D. Blatt, acting Aviation Research & Development director, FAA, has also been named acting chief of FAA's Office of Plans.

Willard L. Landers, former vice president in charge of production and general manager of Fairchild Airplane and Engine Co., has been appointed chief of production of Umbaugh Aircraft Corp., to handle production of the Umbaugh 18 Gyroplane at Hagerstown, Md.

Ray Elston, formerly of Cook Electric Corp., has joined Safe Flight Instrument Corp., White Plains, N. Y. as Flight Operations manager.

J. R. Younkin, chief electronics engineer of Aviation Instrument Manufacturing Corp., Houston, Tex., has been upped to vice president, engineering.

Gene Bowen has been promoted to vice president and general manager of Huntair, Inc., division of The Air Oasis Co. (Cessna dealer), San Diego, Calif.

Dr. Raymond L. Garman, General Precision, Inc., Tarrytown, N. Y., has been named to the newly created post of vice president and chief scientist. He will coordinate all advanced scientific efforts of GPI and its divisions.

Mrs. Dot Lemon, Hollywood, Calif., has assumed the presidency of the Institute of Navigation. A pilot since the early '30s, Mrs. Lemon also holds a Master's degree in meteorology. ION is headquartered in Washington, D. C.

D. A. Cody, general manager of the J. R. Gray Aircraft Company, Dallas, North Texas, Beechcraft distributors, has become president and general manager. Spencer Brent is named assistant general manager. The company was recently sold to a group of Dallas investors.

Rear Adm. Harold B. Miller is reelected for his second term as Commander of Air Service Post, Post No. 501 (American Legion) N. Y. C. Col. Maxwell Kriendler, reelected as executive vice commander.

Kay M. Brick (Mrs. Frank A.) of Norwood, N. J. has been elected chairman of the All Women's Transcontinental Air Race Committee, a position held for the past 11 years by Mrs. Betty (B. Allison) Gillies of San Diego, Calif. who has resigned, but will continue in a consulting capacity. AWTAR headquarters have been transferred from Long Beach, Calif. to Teterboro Airport, N. J.

Edward R. Moore has been appointed as chief engineer of Aircraft Radio Corp., Boonton, N. J. He joined ARC in 1954 as senior engineer.

Don Hanson, West Coast science and aviation writer, has joined Aerojet-General's public relations staff at Azusa as editor of the Aerojet Booster. He succeeds William H. Kennedy.

ROLEX GMT-MASTER GETS TOP TESTIMONIAL

from Pan Am Navigator

Pan Am Navigation Pilot Bernard Lorenz flies with a Rolex GMT-Master

Bernard Lorenz, a Pan American World Airways Navigator, wears a Rolex GMT-Master, the watch that tells the time in any two places on earth at once. He describes its accuracy as "excellent: well within our navigational tolerances."

This top testimonial is due to the high accuracy of the GMT-Master: it is a wrist-*chronometer*, has been subjected to the kind of tests usually applied to large marine chronometers. But its unique feature is that it shows both GMT and local time simultaneously: a revolving 24-hour bezel and a special 24-hour hand make this possible.

"Having GMT available along with local time is a most desirable feature from a navigational standpoint," writes Lorenz. *20 out of 21 airline pilots agree with him.* But not only pilots; any intercontinental traveler would appreciate this watch. Its special features plus automatic winding, automatic calendar, waterproof* case and chronometric accuracy, make it a very special watch indeed.

**With case, crown and crystal intact.*

GMT or local time is read on the main dial. The watch is set to read any other time by means of the rotating bezel and 24-hour hand.

FREE—Rolex Sportsman's Handbook... has valuable hints for boating, sportscar and flying enthusiasts. Write today for your copy.

ROLEX

OYSTER PERPETUAL

Official timepiece, Pan American World Airways

American Rolex Watch Corp., 580 Fifth Ave., New York, N. Y.

APRIL 15, 1928 MT. DIABLO, CALIFORNIA

Yesterday — Charles Lindbergh touched the button that lit a brilliant beam from the Standard Oil beacon on Mt. Diablo. Reported by pilots as far as 150 miles away, it opened up a new era of safer night flying.

This ten-million candlepower beacon was one of six erected throughout the West by Standard to further the development of aviation. It marked another step in a pioneering effort that began in 1917 when Standard developed the first successful aviation gasoline in the U.S.

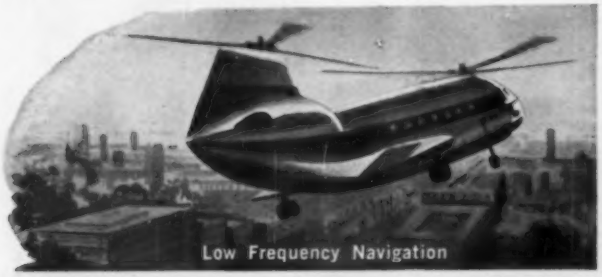
Today — Whether you operate a fleet of jets or a private plane, Standard Oil research is working for you . . . bringing safer, more economical performance. For example, Standard's new underground fueling systems at western air terminals lead the way in safe, efficient fueling. Other research promises new aviation "firsts."

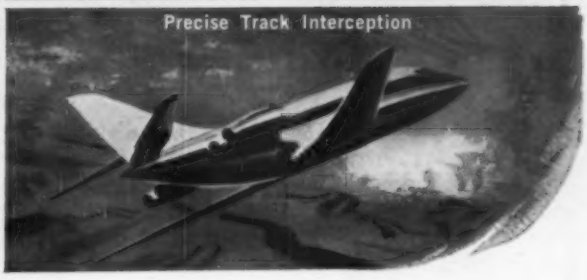
From beacons to fuel storage, jennies to jets — in the development of aviation products and services, STANDARD IS FIRST!

Chevron Airport Dealers take better care of your plane — at over 300 of the West's leading airports.

STANDARD OIL COMPANY OF CALIFORNIA

Now, Fly Your Plane Anywhere . . .
Face Any Navigating Problem with Confidence





with the NEW ***Starflite I***

ARC CD-4

COURSE DIRECTOR

Steering Data from Four Methods of Navigation, Presented on ONE Indicator

The ease with which ARC's CD-4 Course Director adapts itself to every area of operation adds a new dimension to your flying technique.

SELECT MODE, SET TRACK, CENTER NEEDLE

With the CD-4, you simply select the mode of operation... VOR, ILS, ADF, or Magnetic Heading... set in the desired track information, and steer the plane to center the vertical needle. Instantaneous steering information is then computed and continuously displayed on one indicator. All enroute flying, holding, and terminal approach procedures are identical.

NO MENTAL GYMNASTICS

Exacting mental calculations are no longer required. The CD-4 does it for you! It tells you how to intercept and maintain the desired course. Recalculation of headings to compensate for wind is not necessary. Your only requirement is to keep the needle on the cross pointer indicator centered.

And... the total added weight to your aircraft is only 8.5 pounds.

Engineered to the highest standards of quality, the ARC CD-4 Course Director assures typical ARC reliability wherever you fly.

For the advantages and specifications of the complete CD-4 System, see your ARC Dealer, or write for free brochure.

ARC Starflite I

Aircraft Radio Corporation

BOONTON, NEW JERSEY

RESEARCH, DESIGN, DEVELOPMENT AND PRODUCTION OF ELECTRONIC EQUIPMENT SINCE 1928

A Matter of Perspective

GILL ROBB WILSON
Publisher

OUT OF NAPLES for Westover in a combat-weary B-17, we had from the start encountered a surfeit of trouble. This was climaxed when after three hours on the gauges following takeoff from the Azores for Argentina, we emerged momentarily in the clear between two towering thunderheads and triggered a spectacular discharge. The stroke pitted the nose, wrinkled the wing behind No. 3 and warped the vertical fin. Static fingered everywhere and the bomb bay tanks glowed like gas furnaces.

By the time we could see clearly again, the B-17 was back in the cumulus and sheathing in glaze. Trying to outclimb the icing level, we also loaded up the leading edge underneath and had to go down fast. Before the airspeed held, we were almost on the deck and the rattle of ice along the fuselage sounded like the Battle of the Bulge.

Buttoned down aft by a blister station, was another hitchhiker, a graying missionary Priest who had come aboard at Casa. I edged back to make sure he was uninjured, and to offer what reassurance was possible.

The old man was buried in his little black book, but listened understandingly and countered that he too was wrestling with a problem. The White Man's war had divided his native flock. His life's work was in the balance, and Christ had lost caste. I could see that the prospect of being dunked seemed as nothing to him by comparison. I went forward again, and although we were still wallowing, somehow felt good.

"How's our friend doing?" the tight-lipped Major asked.

"Sweating out heathen problems, but he's got altitude on 'em," I assured him, and relayed the priest's story.

A grin began to spread over the Major's face and suddenly the tenseness in the cockpit was gone. The tonic of a man keeping things in perspective despite hell and high water, was irresistible. Here indeed was something to tie to.

Perhaps pilots are especially sensitive to this matter of perspective—the capacity to see things in true relation and relative importance. Every flight plan is a chart to that end. Every cockpit instrument and airway aid is designed to keep fundamentals in focus. Probably one grows acutely aware of the exercise of perspective, or lack of it, about him. In any case, the subject has been gnawing at my mind lately in connection with the problems of our times.

For example—isn't it a fundamental fact that freedom is most honored in that government which is most sensitive to the will of the governed; and does it not follow that those governed honor freedom most by guarding the character of government?

Then why all the pussyfooting and compromising with the welfare staters; the special interest groups; the spendthrifts of heritage for a mess of pottage?

There's no built-in magic in any political system apart from the continuous perspective of the people whose convictions it represents.

And in this whole business of foreign aid—isn't the crux of the matter a question of who deserves it and who doesn't? I'm a little weary of dollars for prestige. What people have ever poured out their sweat to help the world in comparison to the American people? Then, why all the emoting over those who bite the hand that has fed them. Prestige? Bah!

Furthermore, it's humiliating to see millions of good and kind people hanging as though mesmerized around a table where the little ball of human destiny on the wheel of fate is spun by croupiers who have barely learned to tuck their shirt-tails in their pants. Have we no greater sense of perspective than to weigh the relative value of the American heritage in the scales against a few paltry technical achievements wrought by an enslaved people? Has it ever been contravened in all time, that they who live by the sword shall perish by the sword? Where is any tyrant of history except in a dishonored grave? Has communism ever won a single triumph in the realm of moral and spiritual values? Has the instinct for freedom ever died in the heart of the most abject slave? Has truth crushed to earth ever failed to rise again? Are the millions who constantly flee the iron curtain not more valid witnesses to the ultimate end of socialism than the piping of a Sputnik in orbit?

We cannot all be towering figures who wear crowns and crosses incidental to great purpose, but even the humblest of us can exercise perspective and thus contribute to the renaissance of national sanity.

Big Super G18 cockpit gives you room to work, plus space for lots of extra nav/com equipment and radar.

Big separate passenger compartment has new panoramic windows, center aisle, can seat 7 to 9 people.

With its big, dependable 450 hp Pratt & Whitney engines, the Super G18 gives you speeds to 233 mph. Optimum range, with reserve, is over 1,450 miles. Radar can be easily installed in the Super G18's nose.

Beechcraft Super G18...Why Settle For Less?

Today there is still only one twin-engine executive transport that can carry so many people so far, at such high speeds, and with so much roominess, comfort and privacy at such low operating costs.

That airplane, of course, is the world-renowned Beechcraft Super G18, a favorite of pilots everywhere.

Why settle for less—especially when you consider the advantages of Super G18 ownership, including:

1. The Super G18 is a big airplane, built to do a big job, with 3,790 pounds useful load allowance for passengers, baggage, fuel and equipment.

2. Compartmented privacy for pilots and passengers alike. Seating arrangements for 7 to 9 people. Wide selection of optional appointments, including food bar, work tables and other "office aloft" equipment, plus a completely private lavatory.

3. Big inside baggage compartment. Air-stair door.

4. All-weather usefulness with modern weather radar and a wide choice of factory-installed radio and navigation equipment, plus de-icing equipment.

5. Rugged durability for built-in extra years of service with minimum maintenance costs.

6. Lower operating costs than any other aircraft that can do the big jobs the Super G18 can do.

If you want the best, why settle for less? See your Beechcraft distributor or dealer for a Super G18 demonstration soon.

Write today for latest information on low-cost Beech leasing and financing plans. Address: Beech Acceptance Corp., Wichita 1, Kansas, U. S. A.

Beechcraft

BEECHCRAFTS ARE THE AIR FLEET OF AMERICAN BUSINESS

FAA Aeronautical CENTER

Tomorrow's air traffic problems are today's classroom assignment at this unique complex

By JAMES H. WINCHESTER

YOU MAY BE flying into Taipeh, calling the tower at Bangkok or checking with control at Athens. Wherever you may be, the voice that answers you will be speaking English. It may be heavily accented, but it will be English—for that is the international language of the free world's airways.

The man behind that voice, whatever his nationality, in all probability received his training in the United States at the Federal Aviation Agency's $30-million Aeronautical Center at Oklahoma City, Oklahoma.

The training of international students in airways traffic control procedures—several hundred, representing more than 46 countries, have graduated from the FAA's classes in the last 10 years—is only one facet of the many activities of this unique aeronautical hub, which now represents one of the largest educational programs in the U. S. government.

Training at the school falls into four broad areas: Air Traffic Control; the maintenance of Air Navigation Facilities; Flight Standards; and Managements and General Training.

Beyond this, however, the Center also headquarters many other FAA activities. The dry name of "Facilities and Material Depot,"—a part of the Center, which is located on one side of Oklahoma City's Will Rogers Field—masks the tremendous logistical job of getting electronic gear and other supplies out to more than 6,000 FAA facilities, and the work of maintaining all FAA aircraft.

The supplies are housed, for the most part, in a tremendous 15-acre warehouse. Everything from tiny transistors to huge propellers and airplane wings is stored there, ready for immediate order and shipment. The major portion of three huge hangars is occupied by the Center's Aircraft Division, which employs 1,000 persons alone. They work in two separate operations: major and minor maintenance and

overhaul of airframes and engines for the FAA fleet of planes; as well as the fabrication and repair of airborne electronic systems, used by the FAA to check air navigational and communication facilities around the world.

The FAA's Flight Inspection division, which checks navigational aids in the United States and overseas, also operates from the Oklahoma City center. Key to their operations are two Boeing KC-135 jet tankers, recently added to the FAA airborne fleet, and home-based at Will Rogers Field. They are modified as "flying labs" to do high-altitude inspection work. The modification, which cost $250,000, excluding equipment for each plane, was also performed in the Center's own shops.

In their new configuration, these KC-135s are outfitted with special electronic gear enabling their FAA crews to make in-flight checks of ground navigational stations. Previously, the high-altitude checks were accomplished by smaller jets, such as the Lockheed TV-2 and a modified B-57 Canberra. Among other things, these new instrument-checking jets monitor VOR and TACAN facilities to see if all stations are sending out directional headings within prescribed tolerances. Such checks are carried out from an altitude called "the bottom of the jet routes." This is above 20,000 feet. Inside each of these giant planes are three large electronic consoles. Two large control panels receive distance information sent out by eight VOR and four TACAN stations. The information is received from all stations simultaneously.

Also, aboard the jets, there is another and larger console designed to receive information from four distance measuring equipment stations and four additional TACAN facilities. In this way a large portion of the United States can be check-flown on an eight-hour trip. (*Continued on page* 117)

Boeing KC-135 jet modified as a flying laboratory for high-altitude inspection of navigational aids.

Antenna used in training for maintenance of long range radar. Electronics study is a major field.

***Above:* The 15-acre depot supply warehouse. *Below:* Records section houses airmen certificates.**

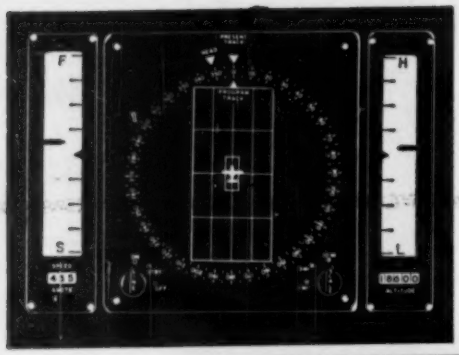


FIGURE 1

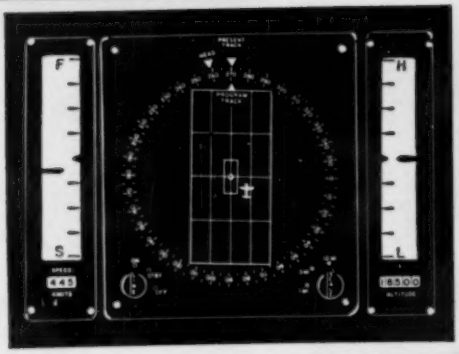


FIGURE 2

Future air safety can be achieved only by means of precise, guaranteed and coordinated flight plans. An analysis and forecast.

By EDWIN A. LINK

The author was the inventor of the Link Trainer as well as the founder of Link Aviation, which is now the Link Division of General Precision Incorporated.

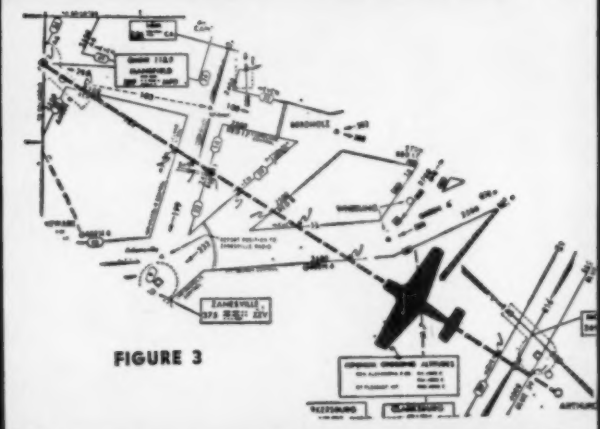


FIGURE 3

TOWARDS BETTER

AIR TRAFFIC CONTROL

EVERYONE AGREES that our air traffic control system is inadequate. Air safety in the United States is not what it should be. In a way, the problem is similar to the old country road established during horse and buggy days; we are trying to patch it up to accommodate our modern traffic when we should be building a superhighway system to take its place.

If we are going to prevent collisions today, and in the even more crowded skies of the future, we must approach the air traffic problem in its entirety—as one of organizing all aircraft so that it is impossible for any two airplanes to be at the same place at the same time. We must make it possible for each aircraft to be navigated so that it can stay precisely in the airspace assigned to it. Actually, when we talk about air traffic safety, we are talking about *precise air navigation*.

If we can agree upon the simple fact that a collision is

impossible unless two or more aircraft arrive at the same place at the same time, then air traffic safety depends on flying extremely precise, guaranteed flight plans which are coordinated and monitored from the ground.

In order to fly a guaranteed flight plan, a pilot must know two things: he must know exactly where he is at every stage of his flight (to a much higher degree of accuracy than today), and he must also know how he is doing by the clock. He must know if he is behind schedule so he can speed up, ahead of schedule so he can slow down, or file a revised flight plan in either case if he so chooses. The first two prerequisites of air traffic safety, then, are continuous, precisely accurate position-fixing, not estimating from one fix to another, and concurrently, continuous measurement of actual position against predicted position.

The third requirement, of course, is effective coordination or control from the ground. FAA is now testing semi-automatic equipment for installation at air traffic control centers and towers which will enable easy and rapid dispatching and automatic prediction of conflicts.

What would it mean then to air traffic safety if more aircraft were flying precise, guaranteed, coordinated flight plans?

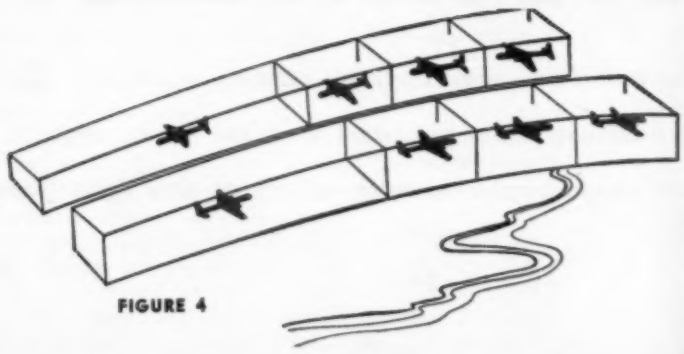


FIGURE 4

First, flight safety would increase every time another aircraft flight were added to the traffic control system, since the location of that flight at every moment would be a certainty and not an estimate on the part of the pilot and, through him, the controller.

Second, work load at the traffic centers would be reduced because the controllers would be working with more and more accurate information, instead of inaccurate data that keep today's controller in an atmosphere of great tension and pressure.

Also—and this would be some distance in the future—with precise navigation a part of normal flight operations for commercial, military and certain business operators, separation criteria could actually be reduced. We might be able to double the capacity of our airspace, which would also assist certain general aviation operations while increasing over-all safety. In addition, since airport arrivals could be predictable theoretically at time of takeoff, landings could be programed in sequence and stacking delays could be greatly reduced.

Since the traffic controllers soon will have advanced equipment to help them with their coordinating function on the ground, all that is needed is supplementary equipment in the aircraft to plot position with continuous accuracy, and to compute actual position against intended position with some simple display to tell the pilot what he must do to make good his flight plan.

Significantly, all navigation system concepts and equipment in use today are more than 10 years old, and were conceived when few aircraft were operating at speeds even as great as 200 miles per hour.

More and more aircraft are now traveling at speeds so fast that there is not enough time for pilots to read and interpret the many instruments, and then to calculate present and future positions with the required accuracy.

The airborne navigation equipment necessary to meet the requirements of the system we are talking about is not presently available, but we have the technology and the skills that are necessary to produce it. There are several ways to solve the airborne navigation equipment problem.

Figure 1 shows one type of position indicator display which could be used in an aircraft cockpit to show the pilot where the aircraft is compared to where it should be according to the flight plan which has previously been set into the airborne computer.

One virtue of this possible design is that it is a positive reading single instrument with which the pilot can compare his immediate position instantaneously with the approved flight plan. At present he must read and interpret a multitude of instruments—with increasing chances of making a mistake.

Here speed and altitude are indicated on the left and right respectively, while the center portion of the instrument defines actual track, drift (*Continued on page* 112)

FIGURE 6

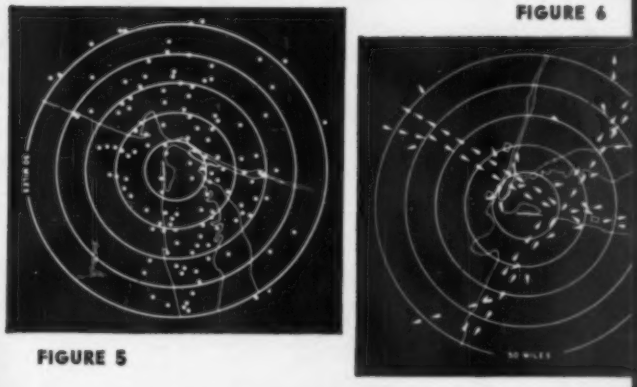


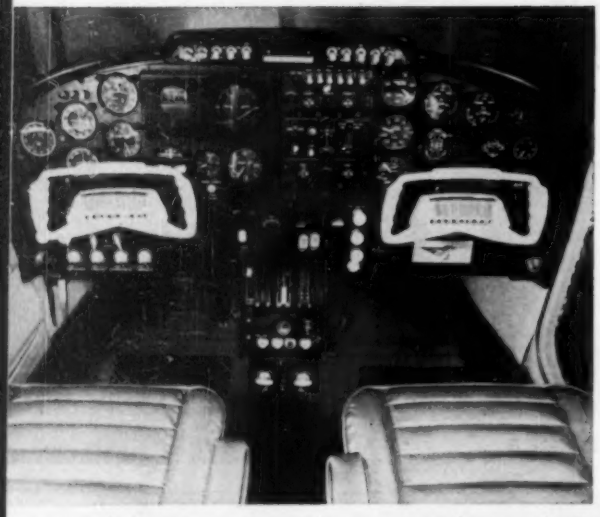
FIGURE 5

CESSNA 320 SKYKNIGHT

Designed and powered for high-altitude flight, the 320 offers business pilots over-the-weather cruise and the highest single-engine service ceiling of any light twin

PILOT REPORT

By A. C. BASS



Instrument arrangement leaves no wasted room. Despite engine instrument location, dials are readable from left seat.

FEATURING a highly sophisticated powerplant package, the new turbosupercharged Cessna 320 Skyknight offers excellent high-altitude performance, and it showed an ease of single-engine handling on a day when temperatures were 40 degrees F above standard.

In its first evaluation flight since certification last May, this fast, five-place executive twin climbed to 21,000 feet in 27 minutes at an average indicated airspeed (IAS) of 138 mph and cruised at a true air speed (TAS) of 247 mph at 15,000 feet.

An extensive survey of the multiengine aircraft market and the need for an economical high altitude long-range light aircraft was conducted by Cessna prior to committing itself to the 320 program. With the Skyknight now in production, the company feels that it has extended its line to 2,800 prospective new customers. The basic price of the airplane is $67,500.

Power for the 320 is supplied by two Continental TSIO-470B fuel injection engines turning Hartzell propellers. With the AiResearch Model T-1106 Turbo-

superchargers installed, these horizontally-opposed six-cylinder powerplants are each rated at 260 hp at 2,600 rpm and 35 inches hg manifold pressure to a critical altitude of 16,000 feet. To gain greater supercharged engine efficiency, Continental reduced the compression ratio of its 470D from 8.6 to 1 to 7.5 to 1 in the new B model, giving the Skyknight a twin-engine service ceiling of 27,200 feet and a single-engine ceiling at 17,300 feet.

The optimum altitude on a standard day is 19,500 feet. At 4,990 pound maximum gross weight the Skyknight can cover 1,110 miles with 130 gallons of fuel on board at a true air speed of 242 mph.

The FLYING evaluation originated out of Cessna's East field in Wichita, Kansas. During the two-hour plus flight the Skyknight was put through its paces more particularly at the higher altitudes. There, engine performance and aircraft controllability could be tested for the potential operators who will be using the airplane in this relatively new area of light twin operation.

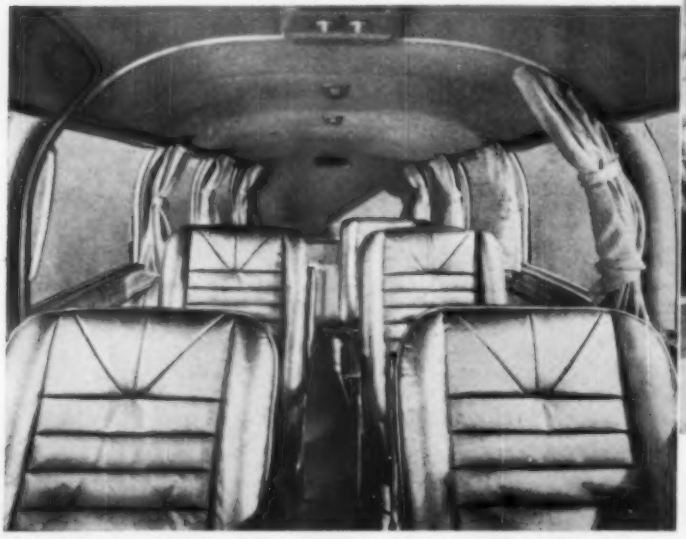
During the walk-around inspection several design modifications were noted as departures from the well established 310 series.

- The tops of the engine cowlings have been faired smoothly into the wings. The waste gate exhaust for the turbosupercharger and the overboard engine exhaust outlets are at the underside of the engine.
- The Skyknight cabin has been extended and raised allowing greater passenger comfort both in headroom and visibility. The larger cabin area is evidenced by the addition of a fourth window and readily distinguishes this aircraft from the 310 models. The side windows are double-paned to cut the noise level and tinted to reduce glare.
- Cowl flaps set into streamlined saw-tooth pods are another noticeable Skyknight item. Controlled from within the cabin, they regulate engine cooling and eliminate the alternate air system.
- At either side of the engines, inset in the leading edge of the wings, are air intakes. The smaller outboard intake provides air for the accessories and to the structure area surrounding the supercharger, while the large inboard intake leads to a filter and enters the compressor as ram air. Loss of ram pressure does not affect supercharger operation. In the event of icing or intake clogging, spring-loaded doors open automatically to take over the ram air function.
- New wheel design on the main gear coupled with higher capacity brakes (almost 100,000 foot pounds more of kinetic energy have been incorporated in the Model 320).

Stepping into the Skyknight's five-place interior presents no maneuvering problems as ample door space is provided. All seats are newly-designed reclining contour types with rolled edges and swing-down arm rests. The pilot and copilot seats are adjustable fore and aft. The aft seats are held in position with snap locks and can be removed individually if cargo or luggage space is required. The baggage compartment is part of the cabin, adjacent to the fifth seat, and has its own door just aft of the right wing trailing edge. With the slope of the cabin angle raised, more utility shelf space is available aft of the fifth seat.

The shock-mounted instrument panel layout is good, with the flight instruments directly across the pilot's line of sight. The engine instruments located to the right of the panel are clear and readable from the pilot's position.

The Skyknight flown for the evaluation was equipped with a $20,000 Group 1 ARC radio package which made a neat installation for the cock- (*Continued on page* 123)



Above: **Continental TSIO-470B engine relies on exhaust-driven turbosupercharger (indicated) for high-altitude performance.** ***Left:*** **Well-upholstered cabin has been extended, has greater window area than earlier Cessna 310.**

Above: Guard F-102s in formation over central Texas. By mid-1962 there will be 27 ANG fighter-interceptor squadrons in the nation.

The Air Guards of South Carolina and Tennessee fly one of the world's fastest, highest-flying aircraft, the Lockheed F-104.

Once the last stop for worn-out Air Force airplanes, the Guard is today an up-to-date combat force

New frontiers for the

Air National Guard

By WILLIAM V. KENNEDY

THIRTEEN YEARS ago, Pete Philippy ran a chicken farm near Reading, Pa. On four evenings each month, and on an occasional weekend, he drove out to what is now Gen. Carl A. Spaatz Field (Reading Municipal Airport) to fly an Air National Guard F-51.

Those were not bright days for the Air National Guard. The component was operating with run-down equipment and run-down facilities. Both Guardsmen and their Air Force advisors were pessimistic as to the chances of improving the situation.

"If it weren't for these 15 days of active duty training each year," a Regular Air Force advisor told me in the summer of 1950, "the Air National Guard wouldn't be worth the fuel it burns."

Today, Pete Philippy is a lieutenant colonel. He is a full-time Air National Guard technician and commander of the $3,000,000 Air Guard installation at Greater Pittsburgh Airport.

Pete's old Mustang gave way to the F-94 when Reading's 148th Fighter Squadron was called up for the Korean emergency. Back with the Guard again, the F-84F, the F-86L and, since last October, the F-102 provided a continuing challenge to airmanship.

The story of Pete Philippy is pretty much the story of the Air National Guard. Both are involved in, or on the threshhold of a more drastic change than all those of the past decade or so put together, and today with increasing world tension, 64 units of the nation's Air Guard have been alerted for active duty with the USAF.

By the middle of 1962, the Guard will convert from an almost all-jet fighter force to a mixed force of Century-series fighters, multi-engine transports, aeromedical evacuation aircraft, tankers, reconnaissance aircraft, and amphibians designed to hustle our new guerrilla warfare units into and out of enemy territory.

The change started with the conversion of several fighter squadrons to F-100s in 1959. It picked up speed with the conversion of two additional squadrons to F-102s and F-104s in 1960. The revolution was really on with the conversion of six more fighter squadrons to C-97 transports, also in 1960.

By July, 1962, the flying squadrons of the Air Guard will add up like this: 27 squadrons of interceptors; 21 tactical fighter squadrons; 12 tactical reconnaissance squadrons; nine aeromedical squadrons; four light troop carrier squadrons; three air refueling squadrons and one medium air transport squadron.

These 92 squadrons will be grouped under 24 wings spread across the country from Puerto Rico to Hawaii.

In all, the transition will affect 3,556 pilots and some 75,000 flight-line maintenance men. Of these, 500 pilots and 8,000 mechanics are full-time Air National Guard technicians.

In the words of Gen. Frank F. Everest, commander of the Tactical Air Command, the Air Guard is no "second team." It is part and parcel of the Air Force's first-line operational force.

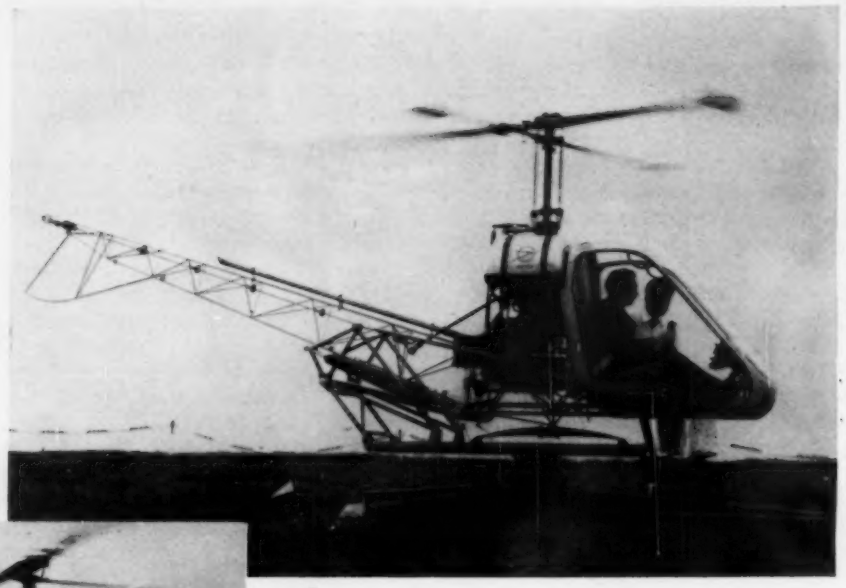
The best evidence of this is furnished by the 22 Air Guard interceptor squadrons currently furnishing runway alert aircraft and crews to the Air Defense Command.

During their active duty, these Guardsmen and their ships are on call, and are employed for intercept missions on an equal footing with Active Air Force crews. The periods of active duty go up to 59 days per man.

In Hawaii, the runway alert program has advanced to the point where the 199th Fighter-Interceptor Squadron of the Hawaii Air National Guard is now charged with the primary air defense responsibility for the islands.

Two years ago, TAC backed up General Everest's words by turning over to Air Guard tactical fighter wings a major part of its demonstration mission at the various Army service schools. The demonstrations provide excellent training for the Guardsmen. They also give TAC observers an up-to-date means of checking on the proficiency of the Guard squadrons involved.

This year, the Guard TAC squadrons will go one big step further with a combat-deployment mission. The mission will be flown over a distance equivalent to that of an overseas deployment, with air- (*Continued on page* 80)



The instructor rides a seat attached to the side of the cabin as the trainer moves in limited maneuvers.

BOLKOW BO-102 HELI-TRAINER

With this device students can learn the fundamentals of helicopter flying without ever leaving the ground

By PETER W. WATKINS

THE BO-102 Heli-Trainer manufactured by the Bolkow Company of Munich, Germany, is a "captive" helicopter designed as a safe low-cost hover trainer for students with little or even no flying experience.

The machine consists of a single-seat helicopter of main and tail-rotor configuration, with skid under-carriage resting on a platform which in turn rests on a universal pivot support. Closer inspection reveals a single rotorblade with counterweight, and a framework of steel tubes with two large springs beneath the tail-boom which keeps the helicopter tied to its landing platform.

An instructor's seat on the left side of the cabin is attached to the platform, and thus follows the cabin in its maneuvers. Extending out on the ground and supporting the platform from beneath, four booms with elastic stops prevent the platform and cabin from tilting more than six degrees in any direction. A two-cycle, three-cylinder engine developing 40 hp at 3,000 rpm powers the Heli-Trainer.

FLYING's evaluation of this unusual flying machine took place at Le Bourget Airfield outside of Paris during the recent International Air Show. Weather conditions were good for helicopter flying: temperature 58 degrees F; relative humidity 70 per cent; wind eight knots with gusts to 12. Dr. Walter Lill, technical development chief for the BO-102 acted as instructor.

Having climbed aboard and strapped in as in a free-flying helicopter, instructions for starting were followed. All clear, ignition key on, electric starter engaged. As engine rpm climbed over 50 per cent, the rotor brake was released, and the clutch engaged. With the needles married, operating rpm was quickly reached (2,800 engine turns, 550 rotor turns). The instrumentation is very simple: dual tachometer, oil temperature and pressure gauges, ignition and starter switch. In addition to the usual cyclic stick, pedals, and pitch lever with throttle grip, all controlled by the student pilot, the instructor has access to an engine cut-out button located to the rear of the pitch lever. This button is actuated to give students practice autorotation landings from a hover.

From his perch outside the cabin, Lill explained that the usual training syllabus for the Heli-Trainer was three to four hours long. First the student is taught to hover using only the pitch lever and throttle. The cyclic stick and pedals are locked in neutral position by three pins beneath the (*Continued on page* 120)

I think we never see the light
Until the sun goes down
Alike upon our lofty dreams
As on the lofty town,
Alike upon our loves and hopes,
Our freedoms and desires
As on the waters brooding 'neath
The sky ascending spires.

How often have I marked in flight
At night some distant place
Which by the garish sun of day
My sight would not embrace,
Reflecting that one never sees
His way so clear ahead
As when the light that's from within
Replaces what is fled.

There is a place for shadow then
In life as in the sky,
A place for pain and doubt and fear,
For tears that will not dry,
And who has inner light will shine
Although the darkness fall
Alike upon his naked heart
As on the city wall.

GILL ROBB WILSON

As the pilot of a powered airplane, you are concerned with the nature of aviation fuel. First of a two-part series on the type and characteristics of liquid energy

PART I **AVGAS**

AVIATION

By RICHARD B. WEEGHMAN

FUELS

A QUIET REVOLUTION has slipped by in the aviation gasoline industry. The story is recorded on a graph in the form of a jagged line that swerved downward suddenly in 1959. It represents the drop in avgas consumption after 56 years of growth. The reason: the burgeoning success and unlimited future of the turbine engine.

The trend suggests that the aviation engineer's dream of replacing the complicated thrashing of the reciprocating engine with the smooth humming of the turbine powerplant is well on the way to reality. Although avgas undoubtedly will be used for many years, fuel industry spokesmen predict a gradual decline in demand.

Consumption of jet fuel actually surpassed that of avgas way back in 1955 in the Western World and is expected to reach the impressive total of one million barrels a day by next year.

How does this trend affect the aviation gasoline used by business and private aircraft and the airlines? One result is a bleak outlook for significant improvements in the future. The reciprocating engine has about reached the limits of efficiency and refinement.

As a matter of fact the specifications set for aviation gasoline grades have remained unchanged, for the most part, for about 15 years.

One grade is almost obsolete: 91/98 octane. And chances are that there will be no new, more powerful grades or major improvements in existing ones. As one technician expressed it, "Why go to the trouble and expense of developing new products for a dying market? Present aviation gasolines are satisfactory for existing engines if they meet specifications."

But although avgas may represent a "dying market" over the long haul, it still represents the primary fuel for some 80,000 aircraft in the private and business category. And there are several factors the pilot should keep in mind in selecting the correct fuel and getting top efficiency from it.

The two vital elements that keep the internal combustion engine running are, of course, fuel—and spark to ignite it. And not just any fuel such as, say automobile gasoline, will give an aircraft engine the smooth reliability and maximum power required of it.

Avgas is a sophisticated hydrocarbon fuel with a long list of qualities designed to make it perform under the varying conditions of flight with changing temperatures and air densities.

It mustn't freeze at the low temperatures of high altitudes, for example, or vaporize to the extent that it causes vapor lock in the fuel system. But at the same time it must have sufficient volatility to insure adequate combustion and quick starting (it won't burn as a liquid, but only when vaporized). It must have stability to prevent chemical breakdown in storage, resist attack on metallic fuel system components and must flow well enough to allow transferral and metering under all conditions—all this plus the proper octane.

The required specifications are standardized by military regulation (MIL-G-5572) and these properties incorporated into the avgas used in civil aircraft.

There are just four grades of avgas in common use. These are 80/87, 91/98, 100/130 (*Continued on page* 96)

Above right: **Aviation gasoline, used improperly, has the potential to damage engines. Piston on the right has been heavily pitted from heat and detonation traced to maladjusted automatic mixture control.** ***Below:*** **Hole burned in piston of same engine caused failure on takeoff.**

PILOT REPORT

This full three-axis autopilot will not only hold attitude, heading and altitude, but will seek and follow omnirange and ILS signals

Cessna 310D controller is mounted on throttle quadrant, instruments on the panel.

MOTOROLA M-4

AUTOMATIC FLIGHT CONTROL SYSTEM

By RICHARD L. SWEENEY

AN AUTOMATIC flight control system which is light enough in weight, small enough in volume and in a reasonable price range for general aviation has been developed by Motorola Aviation Electronics, Inc., Culver City, Calif.

The difference between an autopilot and an Automatic Flight Control System is largely a question of where the line is drawn on how many functions and operational modes are available.

There are on the market now autopilots which have additional capabilities when extra components are added. In fact, what could be termed an automatic flight control system can be put together based on one manufacturer's autopilot and other manufacturers' additional components.

However, when components from different manufacturers are assembled to make up a system, there are extra problems such as space, wiring, power supplies, installation time and labor, etc., even when the extras are basically compatible with the autopilot and each other in design. Reliability also frequently poses a problem.

Motorola's goal in the M-4 was to achieve reliability (and its inherent partner, low maintenance cost) through combining AFCS functions in overall system design and packaging.

Installed in a Cessna 310D, the system was evaluated by FLYING in flights totaling more than two hours, during which almost every mode of normal operation was used and several combinations of modes and functions also were investigated.

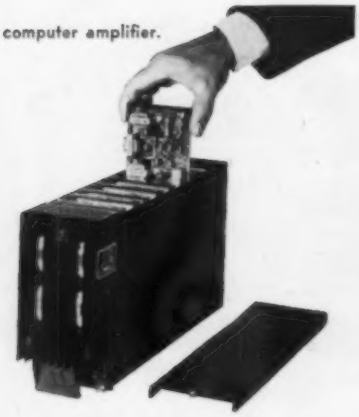
In all cases, the system performed excellently.

Cockpit elements of the M-4 system include four instruments, attitude indicator, gyrocompass, turn-bank, VOR/ILS indicator; three control switches (in addition to regular autopilot and radio master and power switches), the autopilot engage-disengage switch, course director on-off switch; course director monitor switch; and the controller unit itself.

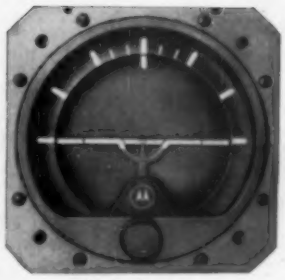
Operational modes and functions built into the M-4 AFCS include: Normal three-axis autopilot flight with manual inputs through the controller unit. Automatic flight on a selected compass heading. Automatic flight on a selected radial of VHF omnirange. Course director operation, whereby information which would otherwise help fly the airplane automatically is used instead to guide the pilot by the vertical steering needle in the VOR/ILS indicator.

Reverse course director operation, whereby normal left-right displacement signals are given by the VOR/ILS indicator when the back course of a localizer or VOR radial is being flown. Automatic coupled flight on ILS, both on localizer and glide slope. Altitude hold, which holds the plane within 20 feet of the selected altitude. Automatic pitch trim and synchronization, which keeps the pitch condition of the airplane and the AFCS in reasonable alignment in both autopilot and manual flight so that engagement or disengagement of the autopilot at any time will not produce sharp pitch axis displacements.

Yaw damper, a feature whereby yaw stability augmentation is obtained with the rest of the autopilot disengaged, which can be used when the aircraft is being flown manually. Roll trim, which can be fed into the AFCS through a small wheel on the controller so that the airplane is not slipping or skidding in automatic



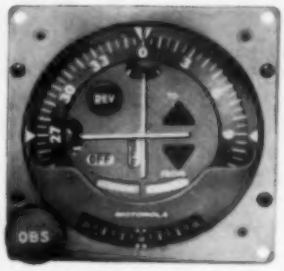
M-4 computer amplifier.



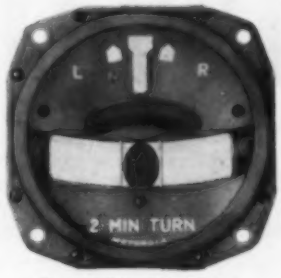
Attitude gyro.

Directional gyro.

Flight controller.



Flight path indicator.



Turn and bank indicator.

flight due to unequal load or other disturbance.

FLYING evaluated the M-4 starting at Santa Monica, used Oxnard and Gaviota omni ranges, included a landing and takeoff from Santa Barbara, further use of the Oxnard omni, Los Angeles omni and LAX ILS.

With three persons aboard, the wing tip fuel tanks full, but not the auxiliary tanks, the craft was at less than maximum gross weight, but still heavy enough to evaluate the AFCS fairly.

Following cleanup after takeoff, the 310 was put on autopilot for climbout, holding a reasonable rate of climb. No specific mode was used, and course and pitch changes were fed in through the manual knobs on the controller unit.

Both pitch and turn knobs are spring-loaded to neutral. The turn knob must be held to make a turn. When released, the aircraft rolls out. Holding the pitch knob results in a continuing change of attitude. The pitch control is best worked as a beep switch, making incremental attitude changes. When the pitch knob is released, the aircraft retains the last commanded pitch attitude.

Response rate to both turn and pitch inputs was satisfactory. In neither maneuver is aircraft motion rough or abrupt, and responses tend to be "soft." Actually, by varying amplifier gain, the system can be made "hard" or "soft," for each type aircraft using the M-4. However, Motorola is seeking a reasonable response rate for all types of aircraft which will be acceptable to the majority of pilots.

With the airplane maintaining a reasonable climb rafe, the altitude hold was activated 20 feet below the desired level of 10,000 feet. The response rate again was reasonably "soft." The aircraft nosed over to level flight at a reasonable rate rather than abruptly snapping over. In all work done with the altitude hold, this mode functioned extremely well.

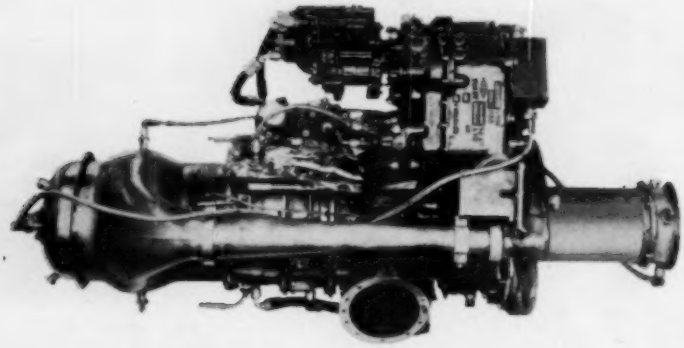
While a respectable angle-off existed between the aircraft's track and the desired radial of the Oxnard omni en route to the station, the AFCS capture mode was activated. The aircraft swung to intercept the selected radial at an approximately 60-degree angle. The track mode was activated a bit earlier than normally, since the aircraft's bank angle is limited to 10 degrees in this mode to avoid wide and abrupt swings while aligning on a radial. However, the system effected a successful tracking with a minimum of hunting.

In M-4 operation, the capture mode is used for intercepting radials at high angles off. The system automatically flies the aircraft to a heading which will intercept the desired radial at about 60 degrees, a function controlled by the computer amplifier. Radial selection is put into the system through the omni bearing selector (OBS) knob on the VOR/ILS indicator. The track mode is initiated when the aircraft is 10 degrees or less off the selected omni radial heading. This function operates on closer gain tolerances in its circuits to make the aircraft closely follow the desired radial, while the capture mode is set up to take the proper cuts at selected radials from large angles off.

When the Oxnard station was passed, the aircraft rolled gently a little each way, then straightened out to lock onto the outbound radial. The gentle rock was in addition to the change in the To-From window of the VOR/ILS indicator.

Inbound flight to SBA was (*Continued on page* 114)

Turboshaft T63 for helicopters weighs 95 pounds.



ALLISON T63 LIGHT TURBINE

A major step in turbine technology, this engine can power either fixed or rotary wing aircraft

By J. S. BUTZ JR.

THE ARMY's Light Observation Helicopter Contract is the most important plum to date in the race to develop gas turbine engines for light aircraft. If current plans are carried through, the Army eventually will put 4,000 of the new turbine powered helicopters into service, with the first of them becoming operational in 1965.

There is a strong possibility that this large military market could put any given turbine engine over the hump and bring it into wide use on lightplanes.

Allison's T63, a 250 shp turboprop/turboshaft engine is the powerplant selected for the LOH program. At this writing three aircraft firms, Bell Helicopter Company, Hiller Aircraft Company, and the Aircraft Division of the Hughes Tool Company, have been selected from twelve competing companies, to build LOH helicopters for a final flight test competition scheduled to begin in about two years. Allison will begin supplying engines to the competing companies in less than a year. Under present plans each company will build five flight test aircraft. The firm which wins the flight test competition will then produce operational models of the LOH.

Clearly, the LOH program is an excellent opportunity for Allison. Large volume production of the T63 to meet LOH commitments undoubtedly will reduce the initial sales cost of the engine. Initial cost is the biggest obstacle today standing in the way of introducing turbines into the lightplane field on a large scale.

All engine companies are facing the initial price hurdle. None of them will discuss the problem in detail because their estimated sales prices for their new gas turbines are perhaps their most important proprietary secrets. However, the general seriousness of the problem is not a secret. If small gas turbine engines are to have a wide market among private aircraft owners or the military, their sales prices must be fairly close to those of piston engines which run in the neighborhood of $15 per horsepower. Right now some turbine engines cost $40 per horsepower and many of them cost much more. The only way to get this cost down is through mass production.

In addition to providing an opportunity for mass production, the LOH program offers Allison the boon of extensive flight testing. A total of several thousand hours of flight time will be accumulated quickly by the three helicopter manufacturers in the LOH contest. There simply is no substitute for high flight time in working the inevitable bugs out of any engine.

Technically, the T63 is termed a free turbine engine. It has a gas producer section which begins with a six-stage axial flow compressor that feeds into a one-stage centrifugal flow compressor. Pressure rise through both compressors is about six to one. From the compressor section the high pressure air is fed into the single combustion chamber. Hot gas from the combustion chamber then enters the high pressure turbine which in turn drives the dual compressor unit. The low pressure or free turbine that drives the reduction gearing and the output shaft lies just beyond the high pressure turbine. Gas leaving the turbine section is channeled through a split exhaust duct.

One of the main features of the T63 is its constant performance over a wide range of altitudes and high temperatures. On a standard day at sea level the engine

Above: The T63 first took to the air early this year in a Bell HUL-1M.

Below: Major engine parts are easily removed with common hand tools.

will deliver its rated output of 250 shp at a turbine inlet temperature of only 1,600 degrees F. Maximum allowable turbine inlet temperature is 1,750 degrees F so that engine power could be increased to about 312 shp at sea level on a standard day if the reduction gearing was designed to absorb the added power. However, the gearing in the present engine is not intended to do this and the extra capability in turbine inlet temperature is used to maintain the maximum 250 shp output as altitude and ambient temperature are increased. It is possible to maintain maximum power output to an altitude of 9,000 feet on a standard day or to a temperature of 100 degrees F at sea level. In effect the T63 is a supercharged engine.

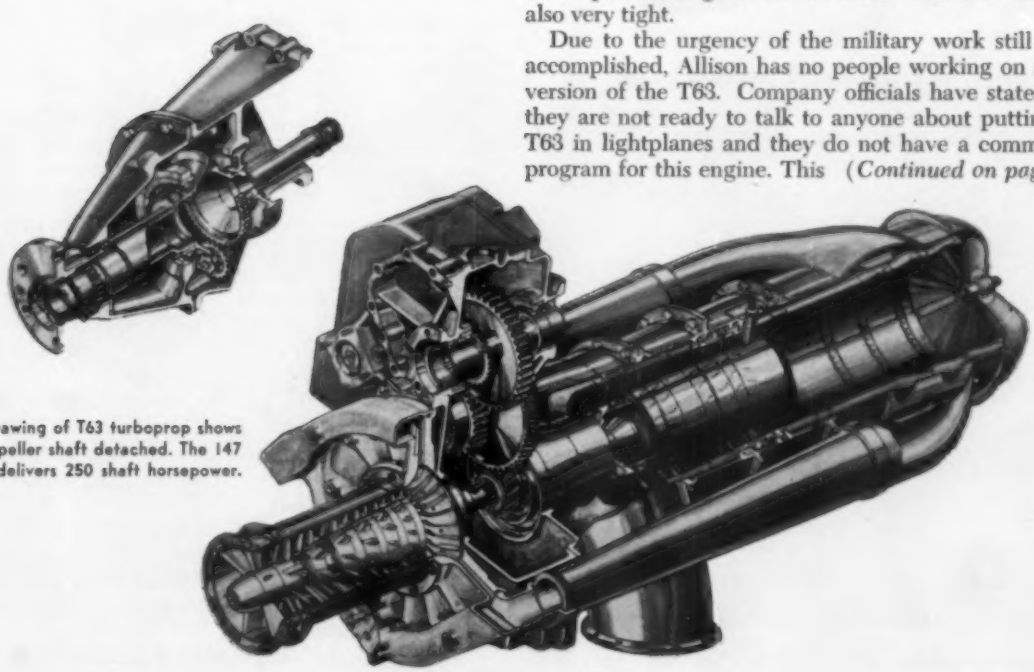
It is anticipated that some time in the future, as requirements develop, that the T63 will grow to a maximum power output of about 312 shp. This will require a strengthened, slightly heavier gear box.

Easy maintenance has been designed into the T63. The primary structure in the engine is the case for the reduction and accessories gearing. The compressor section bolts onto the front of this case and the hot section with the combustion chamber and turbines bolts onto the rear. Loosening a few bolts allows the removal of either the compressor or hot sections in their entirety.

From the manufacturing standpoint, the T63 also has a great deal of potential. All of the wheels in the gas producer section are cast. The compressor wheels and blades are cast as one piece by close tolerance methods and they do not require machining after casting. Both of the turbine wheels are manufactured with this same casting process.

The LOH contract leaves Allison in a fine position to get the best out of the T63's basically sound design. But at the same time it presents the company with some heavy responsibilities and challenges. A tight development schedule has been laid out to get the T63 ready for flight during the next year. The early production schedule to provide engines for the three LOH contractors is also very tight.

Due to the urgency of the military work still to be accomplished, Allison has no people working on a civil version of the T63. Company officials have stated that they are not ready to talk to anyone about putting the T63 in lightplanes and they do not have a commercial program for this engine. This (*Continued on page* 88)



Cutaway drawing of T63 turboprop shows geared propeller shaft detached. The 147 lb. engine delivers 250 shaft horsepower.

Banfe is smothered in leis on his return to Honolulu.

AROUND THE WORLD

Typhoons, red tape and fatigue combined to test the mettle of pilot and aircraft in a globe-circuiting trip by light twin

By CHUCK BANFE

IT WAS A CLEAR and star-freckled night over Honolulu. Gathered at the airport on October 15th were more than 75 persons at a luau hosted by Governor Quinn. It was the night before Aloha Week and the celebration of Hawaii's air courier of peace, Bay Aviation's Super-V, which was to take off to circle the globe.

Of less interest to the Aloha Court members was the second purpose of 17 Bravo's 'Round the World flight. This trip, following a path through the full arc of climate and weather, would be a test of the reliability and integrity of a standard light twin and minimum equipment. If the Super-V could get around the world at a pressure pace without a delay, it would show that a light twin with standard equipment can be a safe and dependable air tool for the traveling businessman.

To establish that the Super-V was standard, NBAA went over the equipment list. There were two Collins VOR, one ELDECO HF, one ARC ADF and one Motorola L-2 autopilot.

Jeppesen sent what they thought was minimum equipment for cross-country flight—one CR-2 computer, one protractor, two pencils plus charts and manuals.

Flight safety foundation laid out the emergency requirements. Granger Associates of Palo Alto sent their new emergency transmitter (which United Air Lines now uses on its Hawaii run). Weighing in at nine pounds, when it hits the water, a tape dissolves and the antenna pops up. Transmission begins automatically on 121.5 for 85 hours to cover more than 300 miles. Airsimmonds Associates sent a SARAH emergency transmitter (now used in missiles). It has a voice function and transmits on HF.

Zep provided oxygen. Not an elaborate installation, but a small portable bottle to be refilled at each stop.

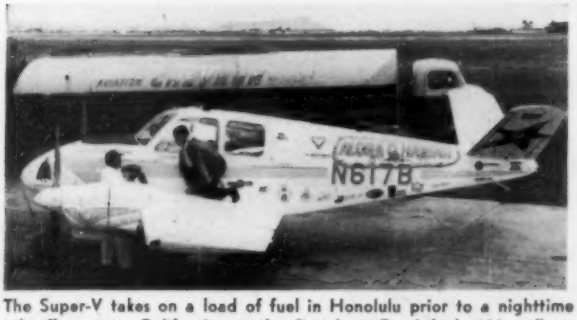
No stay-awake pills were to be used. To fly 18 hours a day for seven to 10 days, long-distance pilot Pat Boling's wife, Joyce, a nurse, suggested a high protein diet with no fat, a high oxygen program and heavy dosages of multiple vitamins. Consultation with Doctor Delbert Rey, then head of the Aero Medical Assn., confirmed this plan.

AOPA laid out the route and obtained all clearances. (Without that being done, the flight would have dragged its V-tail around in a mire of red tape.)

Perfection was the goal set for the Super-V flight. A standard aircraft with standard equipment, installed at an authorized station, would fly the equivalent of a year's flying in seven to 10 days. If not *one* thing went wrong, the flight would be a success. *Any* delay due to mechanical breakdown and the flight would not prove its folder facts.

Takeoff from Honolulu in the blue-black night was incredibly short. The Belt of Orion hung over Diamond Head like a rectangular halo. A light Northeast breeze puffed in from the Pali.

Riding shotgun was all of the emergency equipment. I



The Super-V takes on a load of fuel in Honolulu prior to a nighttime takeoff east to California on the first leg. Total fuel: 300 gallons.

IN 8½ DAYS

By CHUCK BANFE

wore a life jacket at all times, even over land, because of the whistle and scout knife attached.

Thirteen hours and minutes later I was over the Golden Gate Bridge. Fuel remaining was down to four hours. (I carried a total of 300 gallons: 100 in the wings, 50 in the nose and 150 in the rear cabin.)

The layover in Oakland was three hours. Takeoff was with full tanks.

As I passed over Reno, the land below was mantled with snow. It was all VOR navigation.

Daylight came near Emporia, Kansas.

By the time I overheaded Northbrook, north of Chicago, it was apparent that 17 Bravo would have about 12 gallons of fuel remaining at Idlewild. Rather than stretch the flight and attempt to land in the east, I stopped at Battle Creek, Michigan.

With instructions to fill the tanks, I left to get breakfast and file a flight plan. Returning half an hour later, I signed off the fuel and departed for New York.

The stop in New York was three hours. When I returned from customs, I was shown that I needed 288 gallons for full tanks! It meant that I had landed with 12 gallons of fuel if their figures were correct! That was the last time I did not witness fueling and check each tank. The flight plan over the water route to Gander was 22 minutes shorter than the land route. Being a cowardly pilot, I chose the land route.

East of Sydney 17 Bravo went IFR. The next two and a half hours were conducted on the gauges. Because the Super-V instrument panel was the basic-T, it was old home week, for Pan Am's 707s sport the same setup.

Gander Radar picked up Aloha O Hawaii (the name selected in Hawaii) and cleared me for a GCA approach. The ceiling was reported 600 feet and one mile in a driving sleet storm.

Landing was on runway 14 with the wind from the southwest 25, gusts to 35 knots.

Flying the GCA was not hard. Over the end of the runway I had a 15-degree crab. Because of the restricted visibility, the tower did not see the landing. No one was near the runway to see an example of a real blooper.

Gander Tower directed 17 Bravo into the terminal area where dignitaries were waiting. Leis and poi were presented. A phone call to KPOI in Honolulu was made and a KPOI bumper sticker presented for the Governor's car.

After Aloha ceremonies the "Wings of Peace" Super-V was on its way to Shannon. The flight plan was 9:52.

Forecaster Mel Hull had warned me that any delay would result in having to transit two fronts off the coast. Because I was six hours behind, I had to plow into two fronts and spent most of the time across the North Atlantic on instruments.

The original plan had been to fly direct to London, but the Irish government refused to (*Continued on page* 109)

In Bangkok, Thailand's tourism director, Col. Chalermchai Charuvastr, *right*, presents ornamental "Chada" headgear to Banfe for Gov. Quinn.

A platoon of newsmen meets the aircraft in Tokyo, Japan, after a mixed-up report that an Air Force F-104 found Banfe way off course and lost.

When three hours out of Hawaii, a Coast Guard C-130 flew in escort.

PART II

NORTH AMERICAN AVIATION

The forging of a vast armada of front line fighters, bombers, and trainers writes aviation history during WW II

By GILL ROBB WILSON

O-47A 3-man reconnaissance aircraft, here in reworked configuration.

NORTH AMERICAN contributed 42,683 military aircraft to the airpower of WW II, the bulk in three different categories—almost 16,000 trainers, more than 15,500 fighters, and upwards of 10,000 medium bombers. Each category was ready in time for quantity production and each played a stellar role in victory.

Accomplishment of this triumph of readiness involved far flung dispersal of manufacturing facilities, expansion of production area to almost nine million square feet and multiplication of employees to 91,000. Not only were the aircraft designs ready. Management was ready. This seems more of a miracle than the industrial accomplishment per se—unique as it was amidst the egocentric unreadiness of politics and people.

The "too little and too late" aviation assembly lines of WW I had not immediately matured into an industry. Two decades were required to spell out the potential of the airplane.

In a previous article we saw how North American became an aircraft manufacturer; how J. H. "Dutch" Kindelberger and his confreres were matured to lead it; and how it was transplanted in 1935 from Baltimore to Mines Field, Los Angeles.

Our trail now leads through the maturing of North American as a component of a burgeoning industry and covers WW II; this in turn, laying foundations for its role in aerospace rivalry which spearheads the present ideological struggle.

The company's first production airplane, the basic trainer, BT-9, was a portent of great expectations. It established functional precedent in training planes by providing high utilization through ease of accessibility for maintenance and exact standardization of parts for replacement. Likewise it phenomenally duplicated control characteristics of advanced fighters.

With these principles established in concept and engineering, a firm foundation was laid for subsequent refinements, modifications and adaptations. The end result was the AT-6/SNJ family of trainers upon which thousands of WW II pilots sharpened their skills—the "most flown" aircraft in aviation history. But even before the day of the AT-6, modifications of the BT-9 had become famed to airmen.

Within a year it was parlayed via retractable gear and more horses into a brand new category, the BC-1 (basic combat), and as such, modified to RFC specs, went off to the wars in 1938 as the RAF "Harvard I." The Australian "Wirraway"—800 "Harvards" helped prepare pilots to man British Airpower for saving England and later storming of Europe.

France, in turn, ordered 230 trainers, modifications of the BT-14, another member of the BT-9 family. So the precedent setting concept of North American's initial output had far-reaching effects, not least of which was to fortify the company with modest funds for expansion.

Two other projects initially helped North American's takeoff. One was fabrication of 161 sets of floats for Navy's Curtiss Scout-Observation plane—an exercise in production techniques and metal work.

The other was the O-47, functional to reconnaissance —an all metal mid-wing plane featuring radio, cameras, guns and exceptional visibility for a three-man crew—pilot, gunner and observer—the former two-positioned

Jimmy Doolittle's B-25s on the Hornet deck before the attack on Japan.

in a big "greenhouse" topside and the observer in the belly with unobstructed down view. The design was a far cry from the biplanes it succeeded, with their built-in restrictions to observation.

Early designs that did not reach production included the NA-21 "Dragon" twin-engine, midwing, long-range (5,000 miles) bomber and several offshoots of trainer studies: the NA-35 primary trainer, NA-50 single-engine fighter, and NA-44 light attack bomber.

While such aircraft did not win major contracts, each featured innovations which later came into prominence —twin vertical fins, integral tanks, underslung engines, powered gun turrets, ingenious bomb bays, crew oxygen installations, etc. These designs were long strides toward great successors.

For example, the phenomenal B-25, Mitchell, flown

Left: AT-6 trainer in which thousands received instruction. *Center:* NA-40 bomber, forerunner of the B-25. *Right:* NA-73X, Mustang I prototype.

North American Dallas plants at Hensley field with B-24s on the ramp.

P-51 fighters are lined up 15 at a time for engine run at Los Angeles.

first in August, 1940, and thus ready for quantity production by WW II, certainly owed much to North American's previous NA-40 twin-engine attack bomber developments. Six months after the B-25's initial flight, 184 units were ordered, 130 of which were in service by Pearl Harbor. This was the largest order ever placed by the Air Corps up till then and the ordering, short of long service testing, set fresh precedent in aircraft procurement policy.

Although I speak of the B-25 primarily as an example of a timely weapon ready for quantity production due to the foresight of North American, I cannot restrain an airman's appreciation of this noisily magnificent old warrior on its own account. It first came to notoriety with Jim Doolittle's carrier launched strike against Japan. Subsequently it parlayed this defiance into a hardnosed combat record in every single theatre of war. It was the first aircraft to sink a sub. It was the most heavily armed aircraft in the war. It blasted enemy shipping in the Pacific, cut communications throughout Europe, served many free nations in addition to our own in a vast variety of utilizations. It was a pilot's airplane, if there ever was one. If Bill Mitchell had been alive, he would have been well content that the B-25, among all others, had been named for him.

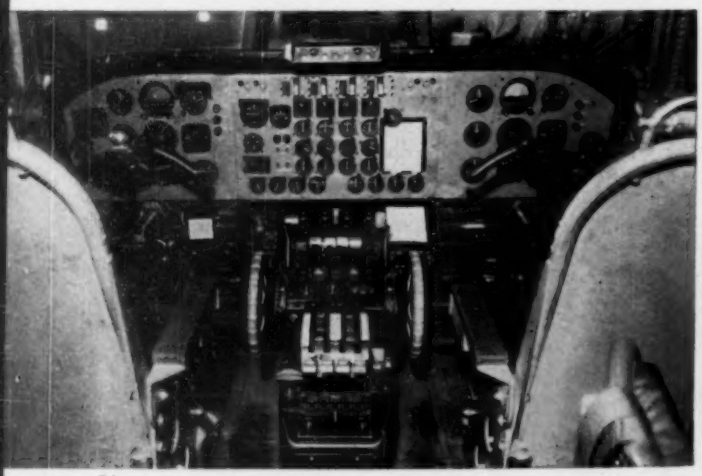
The P-51 Mustang was another case in point. The company had never, hitherto, produced a front line fighter, but had a history of intensive research, development and experiment pointed to that end. Foundations of capability had been laid. The BC-1 and NA-50 had been steps. Additionally, Kindelberger, after pre-war studies in England and (*Continued on page* 92)

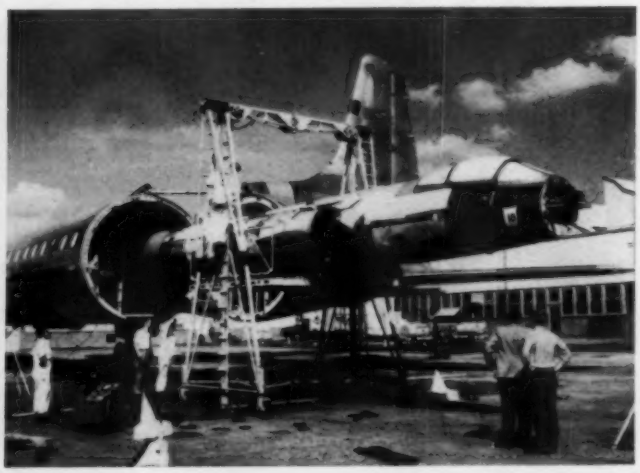
NOW IN SERVICE with two American air cargo operators, a Canadian turboprop is the first commercial airplane designed for all-cargo use. The economy of its operation challenges the truck's for long-distance domestic freight hauling, and can dramatically reduce transatlantic air cargo rates and passenger fares.

Direct operating costs of the Canadair Forty Four cargo plane are 50 to 80 per cent lower than the cost of earlier aircraft: approximately four cents per ton-statute-mile over transcontinental U. S. flights and four and a half to five cents on transoceanic flights of 1,500 to 3,600 statute miles. With a 63,000-pound payload it cruises at 380 to 390 mph over distances to 2,700 miles, and 370 to 380 mps with long-range cruise procedures. On flights to 4,600 miles, the payload is still more than 40,000 pounds.

A proud airplane that requests you spell her name in full, the Forty Four has a host of unusual features: free-floating control surfaces that droop until wind and propeller blast streamline them; a handlebar control column in place of a wheel; four 5,730-ehp Rolls-Royce Tyne 12 turbine engines geared to turn 16-foot de Havilland propellers at low rpm; self-contained mech-

Below left: Simplicity and handlebar control are primary features of the Forty-Four cockpit. *Right:* Two CF-104s can be carried in 84-ft. cargo hold.





Already flying with American air cargo operators, this long-range, swing-tail turboprop offers both economy and speed

CANADAIR SWING TAIL FORTY FOUR

By RICHARD BACH

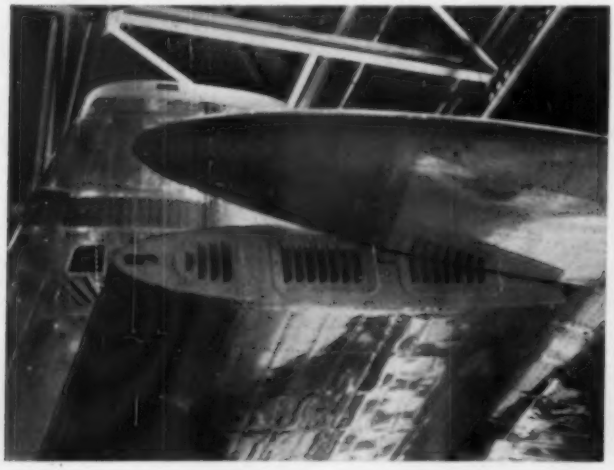
anized cargo loading equipment, and the first working swing tail in the air cargo industry.

FLYING had the chance to test the Forty Four in flight at the facilities of Canadair Limited, the Canadian subsidiary of General Dynamics Corporation, at Cartierville Airport, Montreal. The aircraft flown was N455T, a Flying Tiger airplane and the 25th production Forty Four. It was the airplane's second production test flight; the first had been accomplished without difficulty in the morning.

The Forty Four is a reasonably large airplane. Its wingspan is three feet longer than a DC-8's, its fuselage is 23 feet longer than a Super Constellation's, the tip of its vertical stabilizer is 10 feet higher than a DC-7's. It has a cargo volume of 7,225 cubic feet, and is able to carry 66,000 pounds, more than the weight of two empty Convair 440s, for 3,500 miles nonstop. The cockpit and cabin are automatically pressurized to a 6.55 psi differential, giving a sea level cabin altitude at a pressure altitude of 15,000 feet.

The most outstanding feature, of course, is the tail that swings aside, pivoting on two heavy steel hinges faired at the right side of the fuselage. It is locked during flight by eight hydraulic (*Continued on page* 105)

Below left: Louvers at tip of horizontal stabilizer vent warm air from combustion heater. *Right:* Slatted flaps allow stalling speeds below 100 knots.



Above: Million-dollar Chemung County Airport is turnaround point for 28 scheduled flights each day. Planned is ILS with 600-ft. approach ceiling.

AIR TRANSPORTATION AND THE COMMUNITY

Below: The industrial centers served by aviation in the Elmira-Corning area. At left is Corning Glass Works; at right is Elmira's Thatcher Glass Co.

What is the impact of air transportation on cities that it serves? A report from industrial Northeast with some unsettling facts

By LOU DAVIS

HOW IMPORTANT is air transportation to the community? Do those who do not fly airplanes consider aviation necessary to their economy? How do citizens view airports and airlines?

For the answers to these questions, this reporter flew portions of the Allegheny Airlines and Mohawk Airlines systems, whose combined routes cover 113 cities of the densely populated industrial northeast.

The search encompassed such cities and towns as Bridgeport, Islip, New London, Ogdensburg, Watertown, Ithaca, Utica, Harrisburg, Newark, Hagerstown; it centered on Elmira and Corning, in New York state.

Things looked different as Mohawk's Golden Convair taxied to the Elmira terminal. There was a sparkling new building set against the backdrop of green hills and rich farmland. Elmira is a railroad city. It has a heavily industrialized economy that is beginning to lean strongly upon airlines for flexibility and health in changing times.

Its economy and life has centered about a trading area enveloping four counties; three in New York State and one in nearby Pennsylvania. Its passenger and freight routes have followed the railroads west to Cleveland, Detroit, and Buffalo; east and south to Albany and New York City. Its population is 55,000 plus and the greater trading area is estimated at 230,000 plus. Elmira itself has more than 80 manufacturing companies; the area has 380. The monthly payroll exceeds $14 million. Over 40 per cent of the employed labor force of Chemung County is engaged in manufacturing compared to 30 per cent in New York State and 25 per cent for the nation.

The trade area is served by three railroads—Pennsylvania, Lehigh Valley, and Erie Lackawanna; two airlines, Capital (now United) and Mohawk; high frequency motor freight service over trunkline highways and five state routes. Outlets to water routes are available at nearby Seneca and Cayuga Lakes, via the New York State barge canal system.

Freight and passenger traffic on railroads follows the national pattern with passenger trains almost empty while revenue producing freight schedules hold to a healthy level. At the Chemung County airport, United Airlines operates four flights per day while Mohawk Airlines has 26 flights. Since 1951, airline traffic has grown from approximately 7,000 passengers annually to well over 25,000 expected for this year. Freight, express (*Continued on page* 126)

Rescue

A speck of color hidden in the snow-laden forest held the key to survival in a race against time

By PHILIP WARREN JR.

Illustration by Keith Ferris

at Unreliable Lake

NOT FAR FROM the tiny settlement of Cumberland House, away to the north in Canada's evergreen forests, an Indian trapper was making his way on snowshoes toward his traps. On his way he passed great herds of moose foraging for food.

A hundred miles away, at a trading post, airstrip and communications center called The Pas, a sleepy radio operator was just taking his position at the console. It was dawn on a cold Saturday morning in 1955, and Canada's great distances lay buried in snow. Except for the necessary handful of men who had to be up at daybreak, the rest of the nation slept. It was the beginning of another routine and uneventful weekend.

High above, unobserved by either the trapper or the radio operator, a flight of American B-47 jet bombers was headed for Riverside, California on the last leg of a polar flight. Suddenly one of them burst into flame, began to roll and disintegrate. The pilot, Lt. Col. Kenneth McGrew, and his co-pilot, Capt. Lester Epton, were thrown clear of the blazing fuselage and into the cold morning air. Their parachutes opened and the white wilderness reached up to them.

In the nose, the navigator, Maj. Robert Dowdy, was trapped in his seat, knocked unconscious by the tumbling airplane. Behind him, a tall Texan named Capt. Thomas L. Pittman saw his plight but was powerless to help; the ejection seat that should have fired Dowdy safely into space had malfunctioned. Nevertheless, Pittman remained with the aircraft, fighting a desperate losing battle to free his friend, until he was hurled against the side of the torn fuselage. A yawning hole appeared, and in a second Pittman was spinning free in the air. No one saw his parachute open.

It was no longer a quiet, routine morning.

The United States and Canadian Air Forces maintain air rescue services for just such occasions, to come to the aid of air crews who go down in remote locations. Col. McGrew's wingman called MAYDAY, and one of the most spectacular of all peacetime military operations went into operation.

At the Royal Canadian Air Force Base at Winnipeg, Flight Commander Jack Hudson was the rescue master on duty, and he took immediate charge. For a moment he studied the area, a vast wilderness of snow covered forests and numberless frozen lakes. He sized up the difficulties to be overcome, made a quick check of available airplanes. These included two U.S. Navy planes on a patrol flight near the disaster site; some DeHavilland Beavers of the Royal Mounted Police; two DeHavilland Otters belonging to bush pilots; and a small plane belonging to Saskatchewan Provincial government. He ordered these to the scene to begin a search.

He prepared to send RCAF rescue planes to the area. He felt that even this would not be enough, so without hesitation he put in a phone call to an old friend, Lt. Col. William L. Gibson, commanding officer of the USAF 44th Air Rescue Squadron, stationed at Lowry AFB Denver, Colorado.

Like Flight Commander Hudson, Col. Gibson went into action immediately. His squadron had one crew on alert and another on standby.

The alert rang through the communications lines that link squadrons of the 4th Air Rescue Group at Mt. Clemens, Michigan, San Rafael and Riverside, California. All converged on The Pas.

Jack Hudson would soon have an armada of aircraft and scores of men at his disposal.

While alert rooms across half a continent exploded into action, events that bordered on the miraculous began happening in the north woods. A search crew already on the scene spotted the wreckage of the great bomber, its fuselage torn in half, lying in a clearing. A few miles away, a Navy "Connie" sighted the spreading red panels of two (*Continued on page* 100)

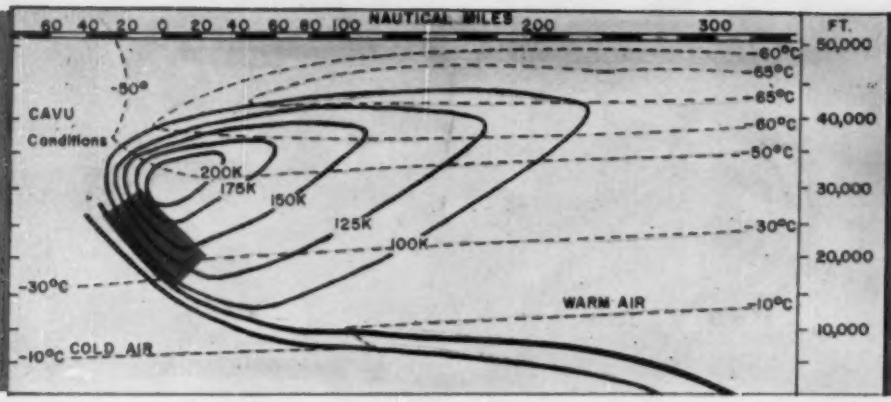


Fig. 1. Jet stream cross section and wind velocities. Shaded area indicates greatest turbulence.

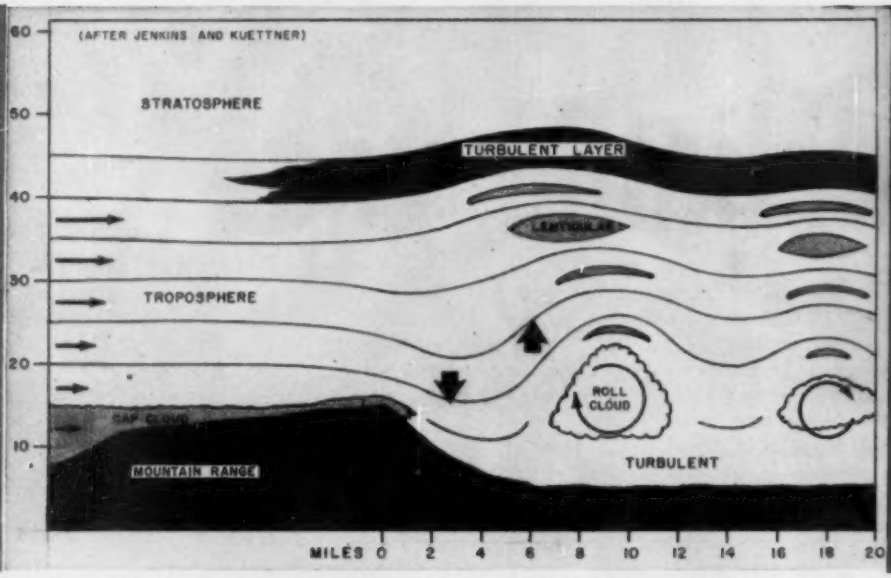


Fig. 2. This stylized drawing of a mountain wave condition indicates turbulent and updraft areas.

Below: **Lenticular or lens shaped clouds identify the standing waves to leeward of the mountains.**

CLEAR AIR TURBULENCE

New research answers questions about these invisible currents of air that affect both airlines and a growing number of business aircraft

By JACK LE BARRON

CLEAR AIR TURBULENCE, or CAT as it has become known, is a jet age word which has become a problem to both airline and military pilots. So much so that a group of civilian and military meteorologists met this summer at Scott Air Force Base, Illinois to discuss ways and means of improving forecasts for clear air turbulence.

With the majority of general aviation pilots flying at altitudes below 10,000 feet, how could this subject be significant to them?

CAT was once thought to be limited to altitudes where only jet aircraft flew, but now it is known that clear air turbulence can occur in the medium altitudes below 25,000 feet, in the realm of "old style" prop aircraft. As more and more business and private aircraft become equipped to take advantage of the cruising altitudes above 10,000 feet, so will the interest in CAT increase.

H. T. Harrison, chief meteorologist for United Airlines says, CAT is an operational problem to be respected. "It is going to be with us as long as we fly aircraft at levels between 10,000 and 50,000 feet," he adds.

Pilots are exposed to turbulence from the day they begin flying lessons, but CAT is no relation to the kind of bumpiness found around cumulus clouds or at low altitudes on windy days. Much of the story on clear air turbulence is yet only a brief outline, but it is known that CAT basically is caused by "wind shear." A more detailed explanation on "why" and "where" it appears must include a few facts about the jet stream. The pilot who goes up to 15 or 16 thousand feet will hardly ever have a jet stream for an intimate traveling companion; however, the jet stream influences U. S. flying weather a great distance from the high speed center.

The story of the B-29 bombers hovering over Japan with nearly zero airspeed is recognized as the real discovery of the jet stream. Previous reports of extraordinary winds at high altitudes has been regarded as excuses from pilots seeking to blame faulty navigation on the wind. But with the numerous reports made by bomber pilots the attitude of meteorologists changed. Shortly after World War II, many agencies began exploring these strange, high-speed rivers of air.

At the present time the main features of the jet stream are clearly revealed. It shifts regularly with the season but irregularly day by day, moving up, down, sideways, or splitting into several smaller "jetlets." The seasonal movement is toward the south in winter, and it is also found at lower altitudes in winter. Wind speeds are, on an average, also highest then. Thus, for general aviation at least, the jet stream can be regarded as a winter hazard.

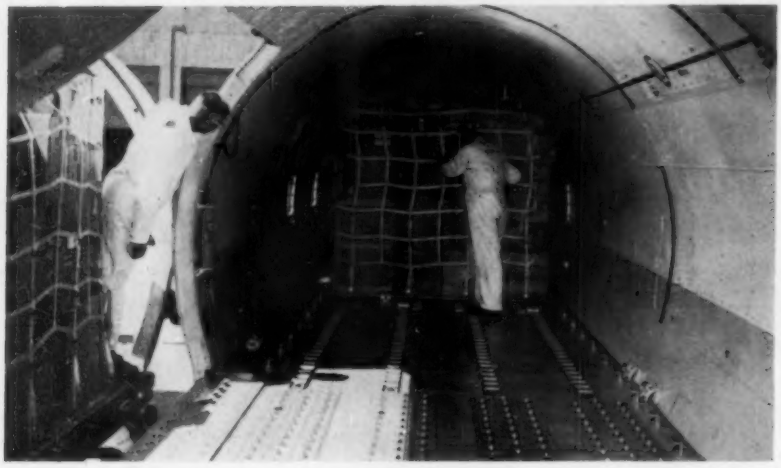
Jet winds are at their swiftest at the core, a 25- to 50-mile wide band at the center. Over the United States the speed is between 100 and 150 knots, but in extreme cases it may reach 200 or 250 knots. Fastest jet winds found so far were clocked at 450 miles an hour over Japan.

Now we come to the wind shear associated with a jet stream. Figure 1 illustrates how the wind velocity drops off rapidly outward from the core, as much as 100 knots in 100 miles on the north side of the stream. The change of speed with height is also very marked. A decrease of 30 to 40 knots in 1,000 feet below the core is not uncommon.

This difference in velocity over a given distance or altitude is wind shear. For example, if the wind at 5,000 feet was westerly at 10 knots and westerly 20 knots at 7,000 feet, the vertical (*Continued on page* 77)

NEWSREEL

TURBOPROP CARIBOU *(Right)*. Canadian STOL de Havilland Caribou, used as testbed for the General Electric YT64 turbine engines. Program is conducted by General Electric's Small Engine Department and de Havilland Aircraft of Canada under sponsorship of the U. S. Navy and the Canadian Government. The T64 develops 2,850 shp and is also available as turboshaft powerplant for helicopters.



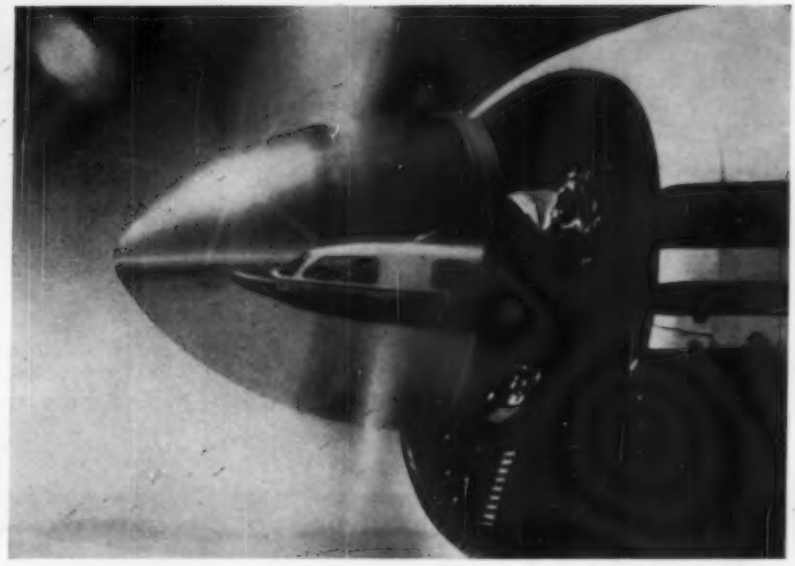
FREIGHT LOADER *(Left)*. Pan American World Airway DC-7CF freighter equipped with AirPak system for fast cargo loading. Deck adjacent to loading hatch is lined with ball bearings and with roller bearing forward and aft of hatch. Freight preloaded on special pallettes is raised by fork lift to the hatch and is easily pushed into the cabin by two men. Snaplocks in the deck hold the cargo firmly.

PUSHPAK *(Right)*. Indian lightplane now in production for schools and flying clubs, designed and built by Hindustan Aircraft, Ltd., Bangalore, India. Aircraft is powered by 90-hp Continental engine, has gross weight of 1,350 lbs. Top speed is 90 mph, range 250 miles.

CARVAIR *(Left)*. British cargo aircraft modified from the Douglas DC-4 to serve as aerial car ferry by Aviation Traders, Ltd. The flight deck has been raised six feet 10 inches to provide space in cabin for five cars and 23 passengers and the vertical tail has been enlarged. Cars are loaded through the aircraft's nose which has a large loading door. Ten Carvairs have been ordered by Channel Air Bridge, Inc. Cruising speed of the airplane is 169 knots.

NEWSREEL

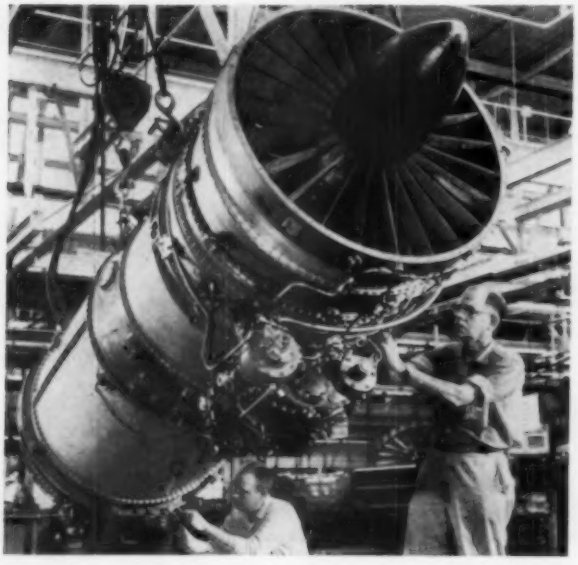
SELF PORTRAIT *(Right)*. An unusual photograph, taken from the copilot's window of an Aero Commander, mirrors the front portion of the fuselage in the spinner. The ground below is reflected in the lower half of the spinner. Its convex shape gives a somewhat distorted and elongated appearance to the aircraft.



WEATHER CANBERRA *(Below)*. A Martin B-57 twin jet bomber in service with the U. S. Weather Bureau's Severe Storms Research Project. Aircraft is equipped with special electronic gear developed by Ess Gee Inc. of Elmsford, N. Y. to take 40 measurements including wind speed, wind direction, air temperature, pressure, water content as well as aircraft's ground speed, latitude, longitude, roll and pitch and many others. Information is placed on magnetic tape for analysis later.

TWIN BEAGLES *(Below)*. Two British light executive aircraft by the BEAGLE Group (British Executive Aircraft Corp.) soon to be placed on the market. Upper photo shows the Beague B.206 a five-place light twin powered by two Rolls-Royce Continental engines of 260 hp each. Cruising speed is 200 mph, range 1,000 miles. Price in England approximately $85,000. Shown in lower photo is the Beagle M.218 powered by two 100-hp R.R. Continentals. Aircraft holds four, has a cruising speed of 135 mph. Basic price approximately $15,000.

PRATT & WHITNEY TURBOFAN *(Below)*. Slated for the Boeing 727 three-jet medium transport, the P&W JT8D turbofan is now undergoing tests at the East Hartford, Conn. plant. Weighing 2,994 pounds, it develops 14,000 pounds of thrust. American Airlines ordered 25 727s.



There are a number of factors which may cause apprehension to a pilot. The remedy for it is within himself

THE PANIC BUTTON

By JOHN T. FLYNN, M.D.

RALEIGH-DURHAM to Teterboro should have been a routine flight. Along the the Eastern seaboard a high-pressure ridge was pushing a low stratus deck and thick haze steadily toward the coast. A dog-leg via Lancaster would give time for the New York area to clear, and ETA at Teterboro would be well before nightfall. The flight should have been routine, with no trouble. And there was none, except inside the pilot's head.

The engine was throwing oil, about one pint an hour, requiring frequent fuel stops; but it had been CAVU since early morning, all the way to Easton by late afternoon. Once across the Delaware, however, the ship slid in under the edge of the receding overcast. Still 1,000 and three, though. The New York Sectional was blurred in the hazy half-light. A quick search for his glasses left the pilot empty handed. He remembered putting them on the counter in the flight office at Lancaster. Cold sweat trickled between the shoulderblades until a second search located the glasses in an inside pocket.

Solberg omni is one-one—one-one what? The overhead spotlights are no help in this half-light. And the ship's flashlight—safe, sound, and a million miles away in the rear baggage compartment. By careful squinting, Solberg omni looks like 114.7. A few cranks move the tuning dial indicator—let's see, Teterboro tower (119.5) reads 119.1 on this set, which would put Solberg omni where? Higher or lower than 114.7? The question was silly but the answer refused to come.

Is this the omni quadrant on Solberg that is unusable or erratic beyond 20 miles? Or was that on the Colt's Neck omni?

The gyro compass was holding steady at an 80-degree heading. But how long since he had reset it? The magnetic compass read 120 degrees, straight to Asbury Park. And this close to the Allegheny foothills, was the tail wind holding steady or shifting?

A glance toward the ground and a sigh of relief. An eight-lane superhighway under the left wing curved off toward the northeast, obviously toward New York City, and easy to follow. The weather 1,000 and two—or a little less. A quick look at oil and manifold pressures—holding steady. Magnetic heading now 70 degrees. The cement compass down below was running a little north.

Abruptly the superhighway ended in a narrow valley —"under construction." He had neglected to check the road for active traffic in the fading light.

Dark ridges began to build up rapidly, squeezing the ship higher into the haze under the overcast. Visibility one mile—possibly. A church spire on a ridge loomed and disappeared, but no town. Still, the biggest target in the world was at magnetic heading 80 or 90 degrees. The magnetic compass had recently been repaired. Had someone checked the compass deviations since?

Try Solberg omni again. One or two blind crankings and Solberg came in with a blast. The heading was 120 degrees to the station. That wasn't possible! The omni must be swinging around aimlessly because the station was too close. Or did the ship's low altitude and the ridges throw it off? If he tried homing on the station, he might be pulled way off course. Solberg omni began to fade rapidly.

Hands on the wheel were cold and wet, feet stiff against the rudder pedals. Magnetic heading still 70 degrees. The aircraft seemed to sense the right direction, even if the pilot didn't. Surprising to find this part of Jersey so hilly, instead of flat. Where were the small towns? Was he close enough now to try Caldwell omni—then he remembered that Caldwell had been decommissioned.

Swallowing was difficult with a dry mouth. Sweat along the belt-line was ignored. The haze and half-light ruined the details of the New York Sectional. Oil and manifold pressure holding. When had he pulled carb heat last?

Suddenly a small airstrip lined with parked aircraft slid under the wing. The ship made the decision and held magnetic heading 70 degrees. Ceiling 900, visibility one mile with luck. Unexpectedly he was staring down at the right-angled runways of Morristown. There was his chance to set down and glue the brain cells together again. But Teterboro is a straight 90 degrees from Morristown. The ship's nose swung directly east and bore through the haze over the ridges. No clear thinking or planning or even compulsion to reach his destination. The ship seemed to know what it was doing.

No glow against the overcast up ahead. Was New York completely closed in? Hands off the omni. ADF would be simpler, with a broadcast band station. Was CBS or was ABC close to Teterboro?

La Guardia radio on 203 had taped weather. A cold hand on the switches finally (*Continued on page* 72)

HERE'S THE BRILLIANT NEW 1962

COMANCHE 180

More beautiful than ever, roomier than anything in its class, the new 1962 Comanche 180 is now flying your way. Its big, roomy cabin has a stunning new interior design. Its new-type Lycoming 180 hp engine assures even greater performance and reliability. And throughout this newest, latest 1962 Comanche 180 are incorporated many design improvements and refinements which spell trouble-free flying for you *with amazing economy.*

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NEW-TYPE

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Lycoming 180 hp Engine

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See it, fly it at your Piper dealer's or write for new 1962 Comanche brochure.

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AIRCRAFT CORPORATION
Lock Haven, Pennsylvania

THE PRO'S NEST

A useful aid to cross-country flying when landmarks are scarce, or the visibility is poor and fuel is running short

Landfall procedure in air navigation

By ALICE S. FUCHS

YOU PEER THROUGH the windshield, hoping for a glimpse of the airport on the river ahead. Check points are few, and what there are seem to be disappearing in the lowering visibility. The weather is closing in and an unexpected headwind has dipped heavily into your gas supply. If you're lucky, you've been able to figure out a ground speed and an accurate ETA at the river. If not, you're worried about what time you'll reach it. In any case, your hope is pinned on that river and the airport on its edge.

Finally a line appears ahead and you breathe a sigh of relief. The river! But your relief is short lived. The airport is not there. Now begins an agonizing time of decision. Should you turn left or right to get to the airport? On a clear day, with plenty of gas and visibility, it wouldn't matter much if you made the wrong decision. At this moment, however, time is a precious commodity. You can't afford to be wrong. In a sweat of indecision you turn to the right and spend some of the most uncomfortable moments of your flying career. A light fog is settling along the river. Your luck holds. Ahead lies the airport and you skim down and land from a straight-in approach.

A rough situation this—but not unavoidable. A simple landfall procedure would have saved you useless worry and you'd have *known* which direction to turn when you reached the river. You had only to alter your original course to the left or right enough to purposely hit the river to the left or right of the airport. Then you'd have known immediately which direction to turn.

Landfall procedure is not designed for the precise navigator who feels he invariably can hit checkpoints on the nose. It's made for the pilot who sometimes isn't sure—who reaches the river, the railroad, the omni radial, finds that the town or airport he's been seeking isn't there, and then has to make the decision—"Is it to the right or left?"

The sailing vessel captains used landfall procedure, and so did the early hunters and trappers, but there's nothing outmoded about the principle. It can be adapted for map reading, omni, ADF or low frequency work, and is widely used in celestial navigation. If you aren't figuring landfalls into your navigation, you're missing a good bet—and may sometime miss your destination.

Briefly, landfall depends on a line through the destination. The line can be a visual one, such as a railroad or coastline, or a radio line of position (LOP) such as an omni radial, a low frequency leg or an ADF bearing to or from a station.

Technically, there are two types of landfalls—speed and course landfalls—depending on which direction the line of position runs in relation to your course. If the line of position is approximately perpendicular to the course, it is set up for a "speed landfall" (Fig. 1). If it lies to the side of and nearly parallel to the course it is a "course landfall" (Fig. 2). In the speed landfall the aircraft alters course to left or right in order to know which direction to turn in order to reach destination along the line of position. (*Continued on page* 84)

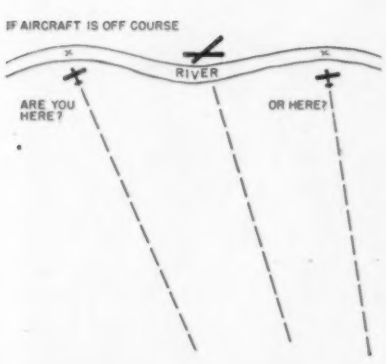

FIG. 1

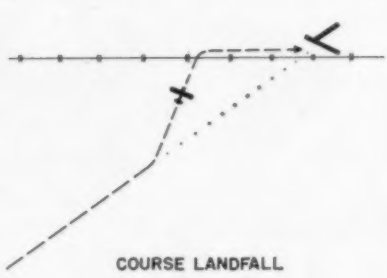

FIG. 2

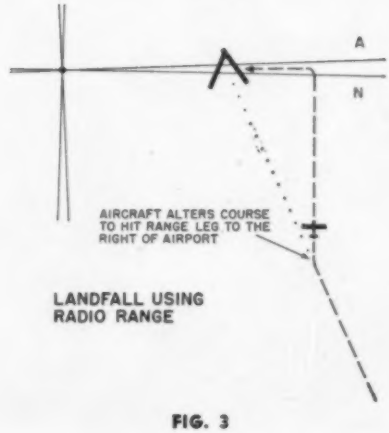

FIG. 3

the cargo was men. They were making short work of an office-to-plant trip. In another few minutes this Hiller will be speeding busy executives to a construction site...giving customers the big picture of job progress...or airlifting replacement parts to head off a costly work stoppage. Properly used, helicopters make real sense when time is valuable...when project sites are remote or inaccessible. Field-proven Hiller helicopters – proven in both military and civilian operation – are on record as the safest, most powerful of the nation's light helicopters. To learn the most practical and economical way to put a helicopter to work for your company, it will pay you to consult the Hiller Commercial Division. Behind our answer is 20 years of copter development, production and service in the field.

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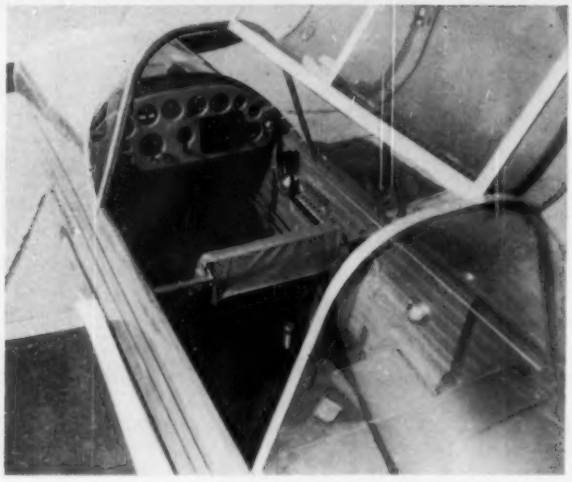

Above: Aircraft is certificated for flight with the canopy full open. *Left:* Dual controls provided. Front instrument panel serves the back.

PILOT REPORT

Full circle visibility and high rate of climb combined in an all-metal aircraft

SHINN 2150-A

By RICHARD L. SWEENEY

DESIGNED ORIGINALLY as a sport and trainer airplane to sell for a low price, the Shinn 2150-A is a trim, fun-to-fly aircraft which has sufficient inherent performance and other features to make it attractive as an executive business machine as well.

The two-place, low-wing, all metal, tricycle gear Shinn evolved from the "Nifty" and then "2150" design of William Morrisey (FLYING, December, 1958), which was purchased some time back by Shinn Engineering Co. Production and design refinements were incorporated into the aircraft, resulting in the currently certificated, in production and ready for delivery 2150-A.

Powered by a Lycoming O-320-A2B engine of 150 hp, the Shinn grosses 1,817 pounds for normal category operations, 1,570 pounds for utility category operations (the plane is certificated for both). Empty weight is 1,125 pounds, leaving 692 pounds of useful load for normal category.

The first impression the Shinn gives is one of tidiness. The cockpit is well laid out and includes such touches as plastic hand grips on tubular controls, giving an indication that details were not overlooked.

Cockpit sides are paneled, with ashtrays, electrical switches and microphone on the right side, along with the radio loudspeaker, which is mounted at the back of the front seat for maximum audibility from both seats. Throttle and longitudinal trim wheel are on the left side of the cockpit, with the trim wheel mounted in a position which makes it accessible from the rear seat as well as front, a handy feature for a trainer.

Control handle for the two-position, manually operated flaps is on the left side cockpit door, is rotated up and back to extend flaps and has a thumb release button on the top to free the mechanical position locks.

Hydraulic main wheel brakes are toe operated on front and rear rudder pedals. These also steer the nosewheel. Parking brake handle is under the instrument panel on the left side. (*Continued on page* 121)

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NO. 257

I learned about flying from that!

The Bonanza was running smoothly, the air was still. But the pilot sensed that something was wrong

By R. D. HOFER

IN THE DAYS of the OX-5, when cockpit equipment was limited to tachometer, oil pressure and compass, there was a saying among pilots that if in doubt about anything go get a cup of coffee and a piece of pie, and think over the situation.

A hunch, intuition, or whatever you called it, occasionally kept a pilot on the ground and saved a life. This may sound archaic in these days of three-mile-a-minute business planes, recorded weather broadcasts, countless navigational aids and instantaneous communications. But in 1929 and 1930 it was considered sound advice by pioneer flight instructors.

Today I cover the United States a couple of times a year in our firm's single-engine Bonanza in the course of carrying on our publishing business. We use all the modern aids available and are thankful to have them. I know more about meteorology and tricks of weather than I did thirty years ago. But an incident occurred recently at the conclusion of a 9,000-mile trip that made me wonder whether there is not still room in the flying business for caution imposed by nothing more tangible than old-fashioned intuition.

My wife had accompanied me on the recent trip in question. We were approaching our home at Banks, Oregon on the last leg of a flight from Washington, D. C. We had left Rock Springs, Wyoming that morning at ten o'clock, where our departure had been delayed by fog. We were anxious to get home as we had been gone five weeks. We had had our quota of violent weather, including thunderstorms, fast moving cold fronts, squall lines and what seemed to be an unusual degree of turbulence in all sections of the country.

On this trip we had been through the southwest, the gulf states, Florida and up the east coast. The day before, between Omaha and Cheyenne, weather advisories included frequent pilot reports of extreme turbulence. Near Sidney, Nebraska we found it necessary to slow down to avoid the danger of structural damage. We were glad that we had shoulder harnesses. On the whole though, it was typical late April weather such as I had encountered on many trips. West of Rock Springs there was a broken to scattered cloud deck at 10,000 to 12,000 feet. The "fair weather" westerlies were blowing 15 to 20 knots on our nose. Turbulence was light. We landed at Boise for gas and to check the weather. There had been a weak cold front forecast to move into western Oregon from the ocean during the afternoon. But as the day progressed, contrary to forecasts, the weather at Portland and over the Blue Mountains east of Portland remained high overcast with unrestricted visibility. We followed the airways from Boise over Pendleton to The Dalles and began our letdown as we passed through the Columbia River Gorge.

Between Boise and Portland we received advisories of extreme turbulence in southwestern Oregon with the approach of the front. This was 300 miles to the south of our destination, so we did not pay too much attention. As we approached Portland the ceiling was definitely lowering, but still remained a good 6,000 to 7,000 feet with visibilities holding to twenty miles or more. We could plainly see the coast mountains west of Portland, some thirty miles away. Banks is located on the west leg of the Portland range, twenty miles from Portland at the foot of the first rolling hills of this range. We have a 1,600-foot turf strip at our home.

I closed our flight plan at Portland and commented to my wife that we were home once more, and it appeared to be the end of another perfect trip such as we had made for many years—yet I felt a growing uneasiness. As we looked far to the west we could see definite signs of deteriorating weather, but it was miles beyond our home. For once the air was smooth; there was no wind either aloft or on the ground. The engine was droning as steadily as it had for the last 9,000 miles. There was nothing to be uneasy about. At last we were circling our home and there were our daughters on the field. The wind sock hung limp. Smoke was rising vertically from the near by mill at Manning, and trees were motionless. Because we had been at altitude for some time, (with oxygen) we double-checked the landing procedure and made a wide downwind leg. At 1,200 feet I lowered the landing gear and flaps and checked the prop setting. We started to turn base leg about two miles from our field, still about 1,200 feet above the ground. The airspeed indicator read between 105 and 110 mph.

Suddenly I felt the ship (*Continued on page* 90)

Cessna 210

Piper Comanche 250

Mooney Mark 21

Beechcraft Baron

Cessna 172

More personal and business aircraft are equipped with McCauley propellers than any other kind.
McCauley Industrial Corp., Dayton, Ohio

MET-L-PROP • JET-FLOW • MET-L-MATIC • FETH-R-MATIC

Panic Button

(Continued from page 64)

picked up 203. "Aircraft declaring emergency—this is La Guardia radio. What is your approximate location?" Somewhere ahead, another unlucky pilot was in deep trouble. "Aircraft calling La Guardia radio —on what frequency are you listening?" A short silence. "Aircraft calling Mayday—set up a triangular course to your right—" A quick flip and the radio was silent.

Thinking and planning had stopped. Dead ahead, at 90 degrees magnetic, was the biggest target in the world. Eyes on the compass, hands tight on the wheel. Keep altitude above broadcast towers. Ceiling 800.

Suddenly ground lights, a highway, a mushroom water tower, and then blank haze dead ahead. The Palisades dropped sheer into the Hudson, directly below the ship; New York, one mile away, was swallowed up in haze. A quick 120 degrees along Route 46, downhill to Teterboro, touchdown on Runway 1, a peaceful empty ramp as the engine died on pull-lean mixture.

The panic was over. The pilot chewed himself out for five minutes, and swore he would never tell a soul. Later, when common sense returned, he decided to learn something from his experience. Most pilots either can't or won't recall their moments of confused terror. Asking around, however, showed that no one is immune. The student pilot on solo who can't find the field 30 seconds after takeoff may be jarred no worse than the ATR in IFR conditions at night who has been denied a change of altitude, who has felt a trace of roughness in No. 4 engine, and whose stewardess reports a passenger gray and pulseless in the cabin aisle.

Little has been written on the subject of pilot confusion. Studies by the RAF, the USAAF in World War II, and the USAF have concentrated largely on the condition of "fear of flying" which may produce a gradual disintegration of the pilot's skill and nerve over weeks or months; but this is surprisingly infrequent, even in combat zones. More acute breakdowns have been seen in aerial gunners who may freeze to their weapons, and be found staring, mute, and unmoving in their turrets. A study of navigators in WW II bombing missions over Europe showed that their skill at calculations tended to deteriorate progressively as the target was approached and improved steadily as the target was left behind.

The briefer disorganizing episodes of pilot confusion need more careful examination, since they must be frequent contributors to disaster. In the episode recounted earlier, the pilot's skills, in spite of 20 hours under the hood, were rusty from a long period of non-flying; an ingrained terror of IFR conditions was aggravated by fatigue, diminished vision at dusk, inadequate cabin lighting, and uneasiness about his engine's performance. Though he felt no serious compulsion to push on, he slipped into marginal weather and kept going, in spite of little navigational preparation for the last short leg of his flight. Tired and already tense, he

(Continued on page 74)

THE THRUST LEVER

By CAPTAIN DAVE KUHN

Halaby's Inheritance

ALL EYES in aviation are trained on the new FAA Administrator, Najeeb Halaby, to observe how he will set about oiling the troubled waters of his agency. His predecessor, Pete Quesada, as the first administrator of the newly formed agency, had just about everyone in the business a bit on edge. General Pete, it must be admitted, was a colorful and direct man. His use of Air Force methods were not always appreciated, especially by people with no military experience. It must be said in his defense, however, there was little doubt as to who was running the Federal Aviation Agency.

The AOPA (Aircraft Owners and Pilots Assn.) developed a strong resentment at paternalistic treatment minus affection. In jig time, a real cold war was being fought in the press, radio and television. The leaders of ALPA (Airline Pilots Assn.) went into orbit when FAA inspectors displaced the fourth man in jets while conducting proficiency checks.

The General stuck by his guns despite a "wild cat" strike on several airlines by pilots protesting his "dictatorial" actions. There was considerable name calling. The Administrator was characterized as a Tzar and Dictator, who used gestapo tactics and acted in an arbitrary, unilateral, hasty and ill conceived manner. Throughout it all the General displayed remarkable restraint. Under the law he held the whip hand. His authority is vested by Congress. A poor balance, to be sure; however, he merely assessed his critics as "special interest" groups and continued to run his agency.

As the public war intensified, AOPA became more sensitive and ALPA more emotional. The principals in the open battle had the "garden variety" pilot caught in the cross fire. ALPA vigorously fought the FAA rule of mandatory retirement at age 60. This seems strange since most airline pilots would welcome an earlier age, as enjoyed by foreign carriers. Stranger still, for the past decade ALPA has negotiated retirement plans with the companies using age 60 as the normal retirement date. One clear lesson is evident, never call a General names if the odds are in his favor.

Even though Pete Quesada stirred up a hornet's nest, much of what he accomplished was in the interest of safety. He created an acute desire to read and abide with Civil Air Regulations. He cleaned up some very sloppy maintenance procedures. He initiated a study of fatigue in jet flying. He improved air traffic procedures. He instigated a study program for future airport and traffic control need. He set forth definite training and check out programs for pilots. He caused his own inspectors to get ratings on equipment they graded others on. He focused attention of Congress on specific needs while at the same time resisted attempts of "special interest" groups to wreck his program.

Halaby's lullaby to his inherited, recalcitrant infant has started on a soft note. His first move was to meet with some of the loudest dissidents for tea and small talk. He has openly invited suggestions from pilots in all walks, via a form letter.

Another equally shrewd move was to set up several task forces to study all aviation problems. These forces, or committees, are made up of representatives from every phase of the art. It affords an opportunity for everyone to expound on any pet project. Aside from any good that may come from the recommendations of such joint effort, these forums will provide an escape valve for hotheads that normally carry a high head of steam.

Of course, any regulations stemming from the recommendations of these task forces have definite risks involved. The responsibility for adopting a poor regulation must be accepted by the people making it. The committeemen will be careful not to invite disaster by cooking up some unworkable rules. Mr. Halaby is proceeding with caution and skill. His program is sound. His psychology is superb.

Before any real balance can be had in the industry, the law must be amended. Pilots are not bent on self destruction. Most of them are normal, hard working taxpayers. As citizens, they should be innocent until proven guilty. When cited for a rule infraction, they should be accorded a fair hearing before a body other than that which accused them. The law should be amended to provide for an unbiased tribunal (non-political if possible) composed of knowledgeable men with no axe to grind. There all segments of aviation could be assured of a fair shake. Individual rights are a sacred heritage. It is an item the Halaby task forces should be getting their teeth into.

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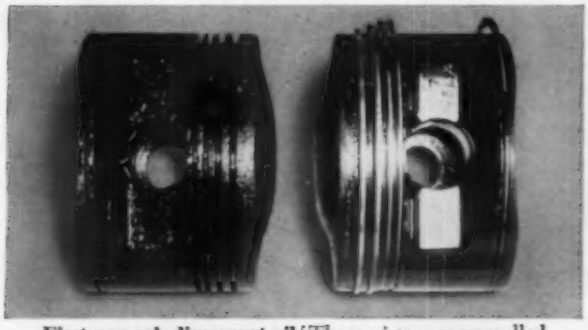

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(Continued from page 72)

switched abruptly from visual reference to his most complicated radio navigation aids, began to distrust them, switched back to ground reference which faded in a blind alley. The terrain became unexpectedly forbidding. Already jarred, the pilot resorted to dead reckoning, though at a considerable distance and time from good reference points and in an inadequate fashion. Another try at the omni left him further confused and distrusting, though a later review of the flight path showed that the omni was very accurate at the time.

The semi-freeze that had set in by the time that airports were sighted paralyzed the pilot's will and prevented him from taking appropriate action. The aircraft's unfaltering, unswerving progress seemed reassuring and partly took away his awareness of his need to control the flight. This passive immobility avoids the danger of overcontrolling the aircraft, especially in IFR conditions, but dangerously led the pilot to ignore the safety of closer airports.

An attempt to ascertain local weather and to use the ADF suddenly emphasized the hazards faced by another pilot in the vicinity, and the resulting reaction was to abandon radio navigation altogether.

By good fortune, New York City came up under the nose of the ship in spite of the crudest unplanned navigation. The pilot's reckoning was dead but he was alive —more fortunate than so many pilots who have been too badly shaken by much rougher flight conditions.

Full tanks, good aircraft maintenance, good flight training with periodic flight checks, good health maintenance, adequate flight planning and preflight inspection are good insurance against the need for a panic button. Yet the pilot is human and not perfect, and liable to a wide variety of mistakes when he develops the "clanks." Much more should be known about such pilot experiences, especially the methods by which the pilot overcame the confusion inside his head and by which he extricated himself from his difficulty.

At present there are no clear-cut rules, but in general the following suggestions appear reasonable.

1) At the first sign of a tight situation, set up quickly and accurately the simplest and most familiar means of solving the problem. In the above case, this would mean careful accurate dead reckoning before resorting to omni. Then the pilot has the confidence and the leisure to set up additional procedures which will be helpful to him.

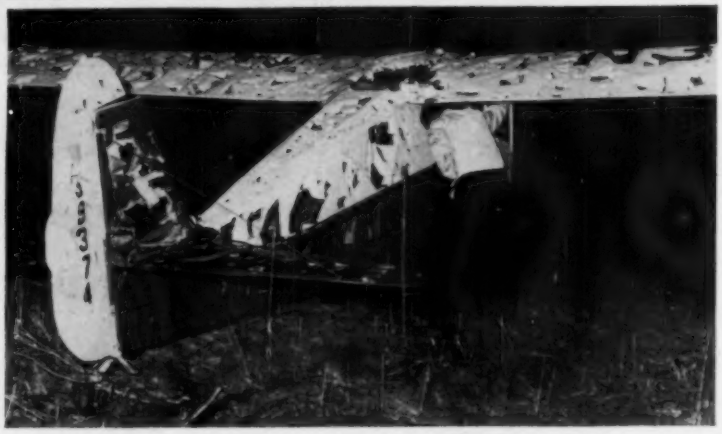
2) Immediately plan an out, carefully and well ahead of the need for it.

3) Don't switch back and forth from one procedure to another. Make a short list, with pencil and paper if necessary and if possible, of problems or procedures; and decide on the order of importance. Move from one item to the next only when the former is under good control or has to be abandoned entirely.

4) Carry in your aircraft a small booklet with clearly marked pages in large print, on which you have outlined simply the step-by-step procedures for operation of aircraft instruments, general navigation procedures, "lost and found" situations, the 180 turn procedure, etc. These clearly written instructions will restore confidence and help in reorganizing the pilot's thinking. But keep such directions simple, clear, and up-to-date.

Other help may be available. The FAA has been instructing ATC operators in emergency talk-down procedures to be used with non-instrument pilots caught on top of overcasts. Such procedures are simple, unhurried, step-by-step, clear instructions which start with the very simplest directions and progress slowly to the more complicated ones for the pilot. Similar "talk-downs" for aircraft malfunctions in flight may eventually prove practical in keeping the pilot calm and on course.

If the pilot's confused state of mind persists and if the lucky opportunity offers itself, he should promptly set down at the first airport in sight, get his bearings, review his procedures, telephone ahead, and calm down. A fool-proof panic button has not yet been invented, but could be more quickly perfected if those pilots who have badly needed one would tell others the methods by which they survived. END



THE AIRPORT AT PEOTONE

PAUL RATHJE wanted to be an airport operator for his town of Peotone, Ill., so he worked in his spare time for four years and he built an airport. He built an operations office, main and auxiliary hangars, storage sheds. He put in tiedowns. Gradually he built a reputation.

Pilots liked Peotone Airport and some who lived as far as 60 miles away kept their airplanes there. Paul Rathje had 21 airplanes tied down and six under repair in the hangar.

Then one day a heater in the main hangar exploded. He was working on an airplane in the field, and when he saw the flames in the hangar his only thought was for the six airplanes inside. In the face of the fire he pushed three of them out, but the other three, along with the main hangar and its shops, power tools, parts and supplies, were destroyed.

Rathje set about to build a new hangar, a fireproof one. Concrete-block walls were up and window frames were in place a month after the fire. Then came a storm in the night and demolished the west wall of his unfinished hangar. The next week the west wall was back up, and both walls were heavily braced with timber supports to stand against the highest of the prevailing west winds until the roof could be put on.

Two weeks later the storm came from the east. Rathje quickly rebuilt the east wall and worked day and night to brace the walls from all directions and get the roof in place.

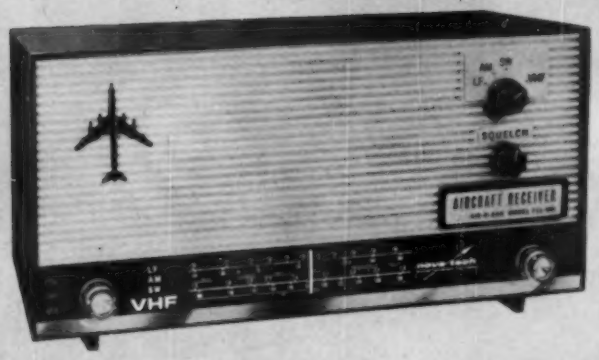
A month later the tornado warnings went out. Paul Rathje closed his airport to flying and set to work securing its 21 airplanes against the remote possibility that a tornado would strike close enough to damage them.

Before it struck anything else, the tornado struck Peotone Airport and the airplanes tied down at the north end of the field. Hailstones that reached eight inches in diameter and came through the roofs of houses found little resistance from airplanes covered with fabric. The tornado pulled tiedowns from the ground and cartwheeled airplanes across the field. It traveled squarely across the Peotone Airport hangar.

When the wind died down, Paul Rathje was left with the concrete foundations of his buildings and with 21 skeletons. The all-metal Cessnas and Luscombes were heavily dented over every inch of exposed surface, and the wings of one of Rathje's own Aeronca Champions were beaten to the ground.

It is sad to watch the closing of a fine airport, especially one that would be operating today but for a series of incredible misfortunes. But every pilot in the United States has a moral stake in the little airport at Peotone, for here in a small way is the embodiment of all that has made aviation in America the wonderful thing that it is for us who benefit from it in business and pleasure. Men who are completely dedicated to furthering aviation for the pure love of the sky are hard to find. Paul Rathje is that kind of man, and he needs help.

IRWIN HIRSH



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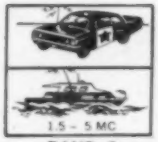

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Clear Air Turbulence

(Continued from page 61)

shear would be calculated as five knots per thousand feet. Shear is also measured over a horizontal distance in the same manner, such as 10 knots per 100 miles.

The severity of turbulence to be expected depends on the degree of wind shear. In the vicinity of the jet stream this factor is the cause of clear air turbulence. Note the velocities below the jet stream core in figure 1. From 15 to 25 thousand feet the shear is nearly eight knots per thousand feet. Greatest horizontal shear, measuring approximately 50 knots in 20 miles, is to the left side or north of the jet core at around 20 to 25 thousand feet.

Unfortunately, clear air turbulence is not constant along an area of wind shear and it must be considered a local situation, occuring in patches 50 to 100 miles in diameter. The thickness of these patches is extremely variable but is generally less than 3,000 feet. Such a local distribution makes problems for the forecaster.

How does the meteorologist stand in relation to the problem of forecasting CAT?

Compared to the state of the art some 10 years ago, his chances for accurate forecasting are very good. J. J. George, superintendent of meteorology for Eastern Airlines, has developed and used with reasonable success, a method for forecasting CAT. Speaking in "Airlift" magazine, he said, "We believe we are usually able to forecast moderate CAT and nearly always able to forecast severe CAT, although at present we cannot really delineate between the two classes. We actually overforecast CAT to a considerable extent in order not to miss significant areas."

Basic differences between the usual turbulence and CAT will be quickly evident to the pilot who encounters it for the first time. With true CAT, strong vertical air currents are conspicuously lacking, a striking contrast to the situation in convective turbulence below or around cumulus clouds. CAT differs in another way; it doesn't try as hard to change the attitude of the aircraft. Its presence is announced by high frequency bumps—like a pneumatic jack hammer working on your aircraft.

Since it is a VFR phenomenon, with limited effect on altitude and attitude, it will be less alarming than turbulence in IFR conditions. Nevertheless, CAT can be as jolting as driving a model-T Ford down a railroad track. Pilots have described it as similar to driving down a cobblestone street at high speed. In its severest form the effect of CAT on both the operation and structure of the airplane can be as devastating as from a thunderstorm.

Normal convective turbulence decreases with altitude and reaches a minimum around 17,000 feet. On the other hand, CAT occurs most frequently above 20,000 with a maximum at 30 to 40 thousand feet. However, these are averages and severe CAT has been reported at all altitudes. One reported case was as low as

(Continued on page 78)

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(Continued from page 77)

7,000 feet. Of the occurrences reported, 75 per cent were classed as light and served mostly as a flight nuisance.

Pilots are mainly interested in the results of a forecast and not how it is prepared; however, several standards employed by forecasters are of interest.

- Regions of CAT are usually associated with those jet streams which exceed 100 knots, and turbulence is usually confined to those portions of the strong-wind region where the winds exceed 50 knots.
- Jet streams are closely associated with frontal systems, and their cores are at the tropopause level, almost directly above the 500 millibar position of the associated front. One rule of thumb is to avoid the region immediately below the jet stream core if CAT is likely.
- Vertical shear becomes important to the forecaster when it is five knots per 1,000 feet or greater. The wind speed at the top of this shear area should be at least 60 knots or better to indicate possible CAT. A suggested figure of 50 knots per 150 nautical miles for horizontal shear is significant when joined with vertical shear.

THE standard information available at Weather Bureau offices will not permit you to attempt your own detailed CAT forecast, yet the vertical shear can be calculated from coded winds aloft reports and horizontal shear will be indicated roughly on the winds aloft charts. The 300 and 500 millibar upper air charts often show jet stream positions and can be used for planning purposes.

In the final analysis you can do no better than to follow the airline philosophy. A roundup of airline opinion shows that transport pilots would plan a flight around an area threatened by CAT. If inflight deviations could not be obtained from ATC, the pilots would forge cautiously ahead at reduced speed.

A booklet prepared by staff meteorologists of Trans-World Airlines, utilizing data gathered in thousands of encounters, gives several more rules of thumb.

- Since vertical shear is related to horizontal temperature gradient, the spacing of isotherms (lines of equal temperature) on an upper air chart is significant. If the five degree C. isotherms are closer together than two degrees of latitude (120 nautical miles), there is usually sufficient vertical shear for turbulence.
- Curving jet streams are apt to be more turbulent than straight ones, especially a jet stream which is curving around a deep pressure trough.
- Wind shift areas (change of direction with altitude) associated with pressure troughs are frequently turbulent. The sharpness of the wind shift is the important factor. Pressure ridges also may have rough air.
- In an area where significant but light CAT has been reported or is forecast, it is suggested that the pilot begin to slow the aircraft to turbulence penetration speed on encountering the first ripple, since the intensity of such turbulence may build up rapidly (in horizontal shear there may be as much as two or three minutes of light turbulence before heavier stuff is encountered). In areas where moderate or severe CAT is expected, it is desirable to slow the aircraft prior to the turbulence encounter.

In introducing these rules, the same authors noted that CAT is of primary concern to high level jet flight operations but may on occasion be encountered by Constellation flights. For general aviation this is a practical guideline: CAT probably won't come down to your prop flight level, but it can. Preparation which results in avoiding or minimizing such a chance encounter is worth its weight in PIREPS.

There is another type of clear air turbulence which is independent of the jet stream and is caused by a "mountain wave." When steady wind strikes a mountain range and is forced up over the top its action is much like a river flowing over a submerged rock: Ripples are formed which may run far downstream. Figure 2 shows how the wind rushing down the lee side of the mountain rises and falls again in a series of waves that may continue for several hundred miles from the mountain.

Mountain waves, sometimes called "standing waves," can often be located by stationary, lens-shaped clouds which cap the crests of the wave. Generally at very high altitude, they are constantly being renewed on the windward side by condensing moisture in the rising air; on the lee side, they are constantly evaporating as the air falls to a warmer altitude. This is the reason they do not appear to move.

If such lenticular clouds are not seen over a ridge, however, don't assume that there are no standing waves. If there is too little moisture, the clouds will not form. Mountain wave turbulence produced under these conditions is obviously going to be of a "clear air" nature.

The turbulence produced by mountain waves is not unlike that of thunderstorms and the techniques of survival are similar; slow down, try to maintain attitude, don't worry too much about altitude so long as you are a safe distance above the terrain.

To produce a mountain wave, the wind flow should be at right angles, or nearly so, to the major ridge line. Wind should be greater than 25 knots at mountain top level, then increasing with height just above the ridge and thereafter maintaining a steady speed or increasing generally with altitude. The stronger the flow the more severe are the effects to be expected on the leeward side.

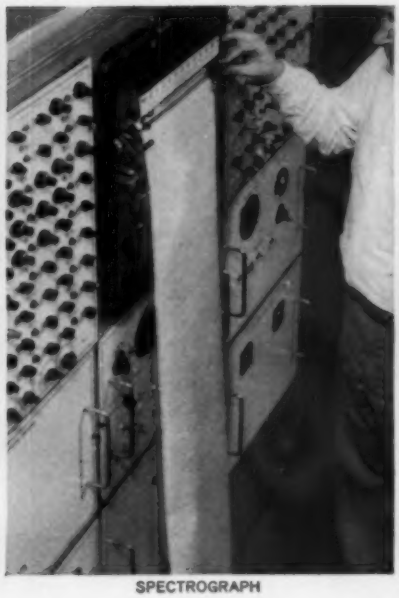
WINTER is the season for maximum production of waves. Over a range like the western Sierra Nevada, for example, waves can be expected during one out of four days with two or three strong waves per month included. Since the effects of the mountain wave can extend well into the stratosphere, its association with a jet stream may produce local regions of high wind shear and severe CAT.

When crossing an area in which mountain waves are predicted pilot technique is to hold an altitude above the ridge line which is equal to one-half the elevation of the mountain.

Besides turbulence, high ridges can play tricks on your altimeter. The effect is the same as that found in mountain passes where high winds create a "venturi" effect,

(Continued on page 80)

METALLOGRAPH



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(Continued from page 78)

producing a low pressure area and an altimeter reading which is higher than actual altitude. Altimeters have read as much as 3,000 feet higher than actual altitudes near high ridges when wind velocity was high.

Should you run into some CAT, a report on it would be useful in the investigations now going on. Make them as definite as possible with time, location, altitude, duration, intensity, etc. Details such as whether the turbulence took place in clear air, or near convective cumulus clouds, thunderstorms, frontal zones, are important. Address them to Clear Air Turbulence Research Unit, U. S. Department of Commerce, Weather Bureau, Washington 25, D. C. A post card will get the job done.

With jet stream caused CAT and mountain wave turbulence, why attempt to fly at high altitude?

"Over the weather" flying has been a long standing desire in aviation, and although pilots in the early 1940s found to their sorrow that 20,000 feet wouldn't top *all* the weather, the higher you go, the more you are in the clear.

Even 15,000 feet is sufficient for much non-frontal weather. Then there are those fabulous tailwinds, especially when eastbound. With oxygen equipment in an aircraft capable of operating way up there, it is hard to turn down an invitation for a free ride. END

Air National Guard

(Continued from page 41)

to-air refueling en route.

These, and other operations have averaged out to about 450,000 hours flying time per year for the past five years.

Such a level of activity denotes more than a force of weekend warriors.

The Air Guard ceased to be a weekend warrior affair about the time Pete Philippy and the rest of the Reading squadron returned home from Korean emergency duty.

In those early post-Korea days, the Air Guard was faced with a major decision—give up trying to be a combat-ready force, or tackle a program of training unprecedented in the history of the reserve forces.

The Air Guard elected to make the jump.

From the traditional 48 "armory" drills per year plus 15 days summer active duty training, Air Guard pilots went to 84 drills plus whatever extra time, in addition to summer training, it took to do the job.

The Air Guard sought, and obtained a major increase in the proportion of full-time personnel. Today, 13,000 out of a total of 72,000 officers and airmen are full-time technicians.

A multi-million dollar program of construction provided base and support facilities at least adequate to support the flying training program.

Out of all this, the Air Guard achieved a unique and, in many ways, enviable position within the Air Force. "The optimum as far as I am concerned," an Air Force fighter pilot said, "would be to have all the benefits of the Regular Air Force, but be able to fly with the Air Guard."

The reason, he explained, was that virtually every mission an Air Guard fighter

(Continued on page 82)

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(Continued from page 80)

pilot flies is a tactical mission, whereas Regulars are taxed with a considerable amount of administrative duties.

Understandably, a force made up almost exclusively of fighter pilots did not rejoice over the prospects of converting to a more mixed mission.

The handwriting was on the wall, however, in the form of improved intercept systems. At the same time, exercises such as the Puerto-Pine maneuver of March, 1960, were demonstrating the need for increased troop and cargo air transport.

"Our single-engine pilots were a bit skeptical at first," Maj. Gen. Winston P. "Wimpy" Wilson, Assistant Chief of the National Guard Bureau for Air, admitted to a Congressional committee earlier this year. "But they are adjusting themselves to the new missions. Many of them had to divorce themselves from the 'lone wolf' concept of a fighter pilot and accept the 'team player' concept inherent in a heavy transport type squadron."

Then, too, there were some attractions. The "over-water" training now required of the Guard C-97 squadrons, for instance, calls for stop-overs at such destinations as Tokyo and Paris. Underneath the glamor, the flights are genuine cargo-carrying missions integrated into the overall Military Air Transport Service function.

A question remains as to whether the Air Guard can handle the vastly more complicated training program resulting from the changes.

The fact that Air Guard squadrons are already meeting and overcoming the problems involved is an encouraging indication. There are certain other reassurances.

The first Air Guard crews to transition from fighters to C-97s scored the highest ratings in the history of the C-97 program.

For two years in a row—1958 and 1959—Air Guard ground and air crews scored at or very near the top in the annual Air Force World-Wide Weapons Meet at Tyndall AFB, Fla. Conversions to new type aircraft ruled out Air Guard participation in 1960. General Wilson expects his crews to be back this year, however, with F-102s and "an excellent chance."

In a series of Air Force-Army maneuvers, designated Dark Cloud-Pine Cone, Air Guard fighters and crews have provided air-to-ground support on a fully operational level. The assignment as the TAC demonstration force grew out of these exercises.

AN important factor in the ability of the Guard to handle increasingly complicated weapons systems is its stable and relatively low-cost maintenance force.

The Air Guard technician is a permanent resident of a nearby community. In most cases, he owns his own home. He provides his own recreation, medical care and dependents' services. Consequently, he tends to stay around.

The Air Guard's reenlistment rate, including both full-time and part-time airmen, is 59 per cent, the highest of any of our armed forces.

Despite generally superior maintenance, the principal problem of the Air Guard at present is in the area of flying safety.

Although its rate per 100,000 flying hours has been declining, the Air Guard's accident rate is still appreciably above that of the Active Air Force, when considered as a whole.

"This is due primarily," General Wilson says, "to the fact that the Guard has a greater percentage of fighter-type aircraft. It is characteristic of fighters that their ratio of takeoffs and landings to time in flight is higher than that of bombers or transports. It is on takeoffs and landings that the highest percentage of accidents occur. When reviewed by type of aircraft, the ANG accident rate compares very closely with that of the USAF." The New Jersey Guard's elite 141st Tactical Fighter Squadron, for instance, has flown nearly four years and 14,500 hours in their F-84Fs without a single major accident.

OF lesser moment, but still of considerable importance to future operational efficiency, is the Air Guard's current and future need for enlisted flight engineers.

About 250 engineers, in grades from staff sergeant to master sergeant, will be needed in the C-97, KC-97 and C-121 units already in existence, or due to be converted within the coming year. A minimum of 63 days full pay each year, plus flight pay, goes with the assignments.

Not to be overlooked in the Air Guard program are the communications and electronics units.

There are 75 of these in 29 states, Puerto Rico and the District of Columbia. Included are aircraft control and warning units, ground communications units and units of the Ground Electronics Engineering Installation Agency.

Sixty per cent, or about 40, of these units, including 15 GEEIA squadrons, are earmarked for recovery missions in the event of enemy nuclear attack. They would restore communications centers knocked out by enemy action, and expand the capacity of alternate centers.

In training for this mission, the GEEIA squadrons have been spending their 15 days of active duty training each year working on programmed communications construction projects. The result has been a savings to the taxpayer that, in some cases, exceeds the entire public investment in the units concerned.

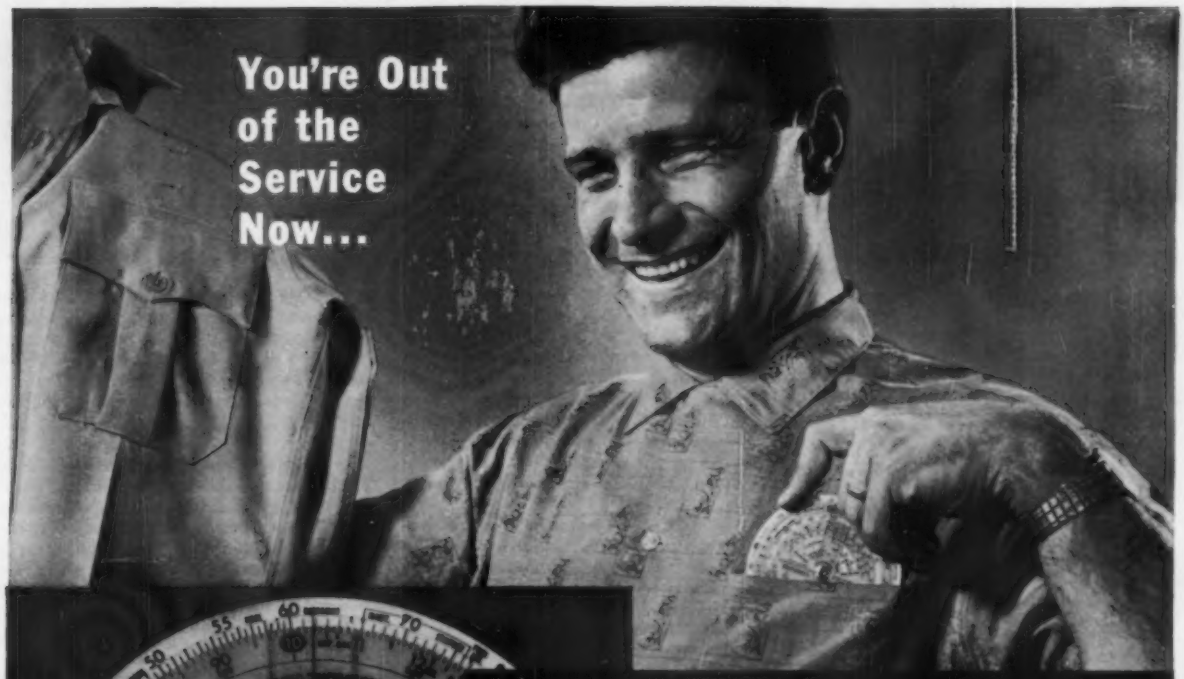
The advances made by the Air Guard during the past 15 years can be traced to two factors.

First is the concept of the Air Guard as a participating member of the overall Air Force team. The second is the state status of the Guard.

By laying on mission-type assignments, and providing the resources necessary for performance of such missions, the Air Force has evoked the best the Air Guardsmen had to give.

The "chicken" in this process, however, was the solid state and community foundation on which the Air Guard is built. The stability characteristic of the National Guard for some 300 years, and the extra push provided by the moral and material support of the states and home communities put the Air Guard program over.

So well has the program gone over that the Air Guard claims to be "the most combat-ready reserve force in the world." The months ahead could very well put that claim to test. END



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Landfall Navigation

(Continued from page 66)

In the course landfall, the aircraft alters course toward the line of position and latches onto it well in advance of the anticipated time of reaching destination, so that the pilot can be sure he hasn't the destination when he gets on the LOP.

Let's examine the different methods of using landfall.

The most commonly used *visual* lines of position are rivers, coastlines, railroads and highways. The point to remember in using any landfall is to alter course to the left or right so as to know which direction to turn when you reach the line of position. In Fig. 2 the pilot alters his course to the left because this results in a shorter distance than if he turns right. When he reaches the railroad line of position he knows he is left of his destination and he merely turns to the right and flies along the tracks to the airport.

It is important, when using landfall procedure, to be sure you have the right LOP. You'll be embarrassed if you fly up the wrong highway or the wrong railroad track, and this can easily happen in some of the crowded sections of the country. One of the best ways of checking the LOP is to note your heading and drift as you fly along the LOP. You can also use estimated ground speed to calculate an ETA at the line of position.

Landfall procedure can be used in connection with a low frequency range to hit either an airport or the station itself. Assume that you wish to reach an airport located on a leg of the range. In this case, under VFR conditions, it is not necessary to go to the station before reaching the airport. Simply treat the range leg as a line of position and plan to intercept it either left or right of the airport, so that you will know which direction to turn in order to get to the field.

IF you are in the middle of a range quadrant and wish to hit the station exactly, you may miss it if you try to fly directly to the station. Choose one of the two range legs bordering the quadrant, fly perpendicular to it and, upon reaching it, turn toward the station and fly along the leg to the station. Another variation is to fly parallel to the leg you do not wish to hit, until you hit the desired range leg. All of this assumes you known which range quadrant you are flying in.

With omni, setting up a landfall is a cinch. If your destination lies within reliable range of an omni station, simply tune to the omni station and set the course selector to the radial which passes through the airport (the bearing from station to airport). Fly a heading that is sure to intercept the radial either left or right of the airport. Then when the needle centers, turn and fly along the radial to the airport. In some cases, where you intercept the radial in such manner that the airport is between you and the station, it is best to have the course selector tuned to the *inbound* bearing from airport to station (the reciprocal of the radial).

Many omni receivers, even on small sets, may be used to fly the localizer of the Instrument Landing System (ILS) to an airport. Once again landfall procedure insures your reaching the field with accuracy. When you near a field with ILS facilities and you have a set with the localizer feature, the omni set may be tuned to the localizer frequency. Information about localizer facilities may be obtained from government radio facility and letdown charts or from Jeppesen charts. The "blue" sector of the ILS, which is indicated on the radio facility chart, is always on the right as one is inbound to the station on the front course of the ILS. The "yellow" sector is on the left. The omni needle by pointing to blue or yellow on the omni dial, will, when the set is tuned to the ILS frequency, indicate whether you are in the blue or yellow ILS sector. For landfall procedure, fly a heading which will assure your intercepting the localizer some distance out from the field.

AS soon as the needle gets near the center, begin turning toward the inbound localizer heading, and when the needle is centered fly in toward the field, bracketing the localizer to keep the needle centered. If you have ILS equipment in your plane, you should get enough VFR practice with it that you know how to fly it. It is important always to get control tower clearance for flying the ILS.

Making a landfall with an ADF is slightly more complicated than with the omni, but is not too difficult if you know how to intercept a given track toward or away from the station.

If the airport lies fairly close to any radio station suitable for ADF work, it may be best to home to the station and then track out the course to the airport. However, if the radio station lies on the opposite side from the airport or is some distance from the airport, the following procedure may be used. Draw a line from the radio facility through the airport and determine the magnetic bearing from airport to station. Say the magnetic bearing is 090 degrees. If you are headed directly toward the airport, alter course so as to reach the line of position to one side of the airport. Calculate the angle at which the new heading cuts the line of position from designation through radio station. When the ADF reads the same number of degrees off from zero as the angle at which the heading crosses the line of position (080 here), you are on the line of position.

Turn and fly to the airport, tracking toward the station. In this way you will fly over the airport.

Landfall procedure is not a remedy for all navigational ills. You won't use it every day and there will be many situations where you *could* use it but don't need to. However, it's an ace to keep tucked up your sleeve for times when the going gets rough —when landmarks are scarce or when reduced visibility blots out those available, when gas gets low and you can't afford to overfly your destination, the rare times when for one reason or another you'd be in some difficulty if you didn't "hit it on the nose." Landfall usually requires a little more time than if you fly direct to destination, but is frequently a more certain way of getting there.

You can't be right all the time, and if you must be wrong, know on which side your error lies. END

SOON . . . YOU, TOO, WILL BE ORBITING

The advent of DME is opening up a whole new concept of flight patterns and approaches. Heretofore all routings, while sometimes far from the direct route you've filed for, have been a series of straight flight segments. Now you may be flying in circles . . . or parts of circles . . . and find yourself happy doing it, VFR or IFR.

Let's say you're IFR to Florida from the north on Victor 3 which takes you, and practically all other north-south traffic, through the bottleneck of the Jacksonville Omni.

As you near Jax, the Center tells you to circle Jacksonville to the east, radius of 15 nautical miles until intercepting Victor 3 south of Jacksonville. Nothing to it. You fly until your DME says you're 15 miles out, then turn east and fly in a right hand curving flight path keeping your DME needle on 15. You're by-passing Jax with the greatest of ease—no holding, no changing altitude. This is just as handy a procedure if you're VFR, too, for getting around a congested area.

This type of circle flying—or orbiting—will become a common thing and a great boon to expedite traffic handling.

Flying the orbit will be found to be quite a simple matter. It's actually a series of straight flight paths. You fly at right angles to whatever bearing you have on the Omni, until your needle shows you're increasing the distance between you and the station. When this happens you change course about 10 degrees and hold that until the distance starts opening up. Then change course again. There's no trick to it and very little practice is needed. Only when you're less than three miles away from a station do you actually fly a continuous banked turn.

This ability to fly around an Omni station at a constant distance, like a gas-powered model airplane on a control line, leads to the ability to set up orbiting approaches with the aid of DME. At airports which don't have their own ILS or range approaches, you can make an approach by flying an orbiting path whose radius is the distance of the airport from the Omni station. And you can set up left and right orbital approaches so you can approach either end of the runway depending on wind. Some such approach procedures have already been published by FAA and many more will be making their appearance in the near future.

Nice thing with DME, too, is that procedure turns and other time-consuming maneuvers are generally eliminated. Funny thing, a curved (DME) path may be the shortest distance from start of approach to the runway.

Regards,

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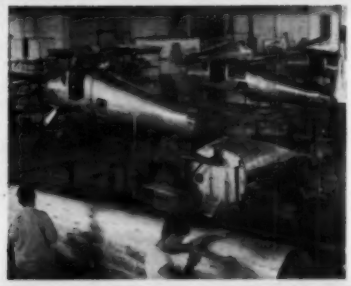

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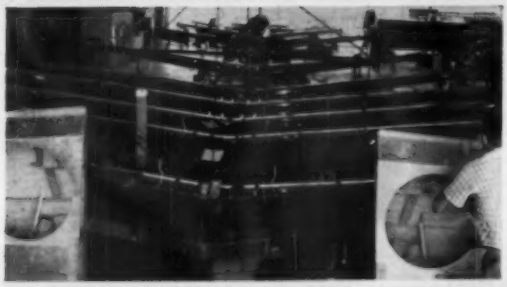

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Allison T63

(Continued from page 49)

step presumably will come in a couple of years or possibly a little longer, after the LOH helicopters are all flying satisfactorily from the powerplant standpoint.

As far as the eventual lightplane use is concerned, however, Allison is doing the most important thing it can do today from a design standpoint. The T63 is being designed, with Army approval, to Federal Aviation Agency specifications. The engine will be FAA certified when it flies in the LOH flight test helicopters.

Allison began design work on the T63 under a $3.2 million fixed-price contract from the Army. In 1958, when the contract was awarded, it was estimated that these Army funds would cover about half of the development costs. Allison agreed to finance the remainder of the work.

AFTER about three years it has become very clear that the first estimates of development costs were very low. Therefore, Allison, under the terms of the contract, now has much more money in the T63 than the Army does.

The primary reason for the high development costs, is that the T63 is a very advanced engine design. Its original specifications pushed well beyond the 1958 state-of-the-art in engine technology. For instance, its turboshaft version for helicopters was to produce 250 shp for an engine weight of only 95 pounds. The turboprop model was to deliver the same power at a weight of 110 pounds. It has not been possible to meet these weights and the revised specifications call for a turboshaft weight of 128 pounds and a turboprop weight of 147 pounds. Apparently there will be no hitch in meeting the new specifications.

At first glance the increased weight of the T63 might seem to indicate failure. However, even though it was not possible to meet the very ambitious design objectives first laid down, the T63 is still a major step forward in small gas turbine engine technology. With its new specifications the T63 still produces almost two horsepower per pound of engine weight. This compares to about .6 horsepower per pound for small piston engines. Late design turbine engines of larger power than the T63, generally match the two horsepower per pound figure. But smaller gas turbines of less than 200 shp output are not nearly as efficient as the T63 and deliver only about one horsepower per pound.

These engine weight comparisons point up one of the main problems concerning the development of small gas turbine engines. As engine size goes down it becomes increasingly difficult for the engine to have a high power to weight ratio and produce two or more horsepower per pound. Allison has run head-on into this problem with the T63.

There is one principal reason for the size problem and that is the engine accessories. It is almost impossible to reduce the weight of engine accessories below a certain point. Starters, fuel controls, etc. weigh just about the same whether an engine produces 1,000 shp or 250 shp. Therefore, the T63 and smaller engines have a relatively large percentage of their weight in accessories and there seems to be no way around this situation.

Another contributive factor to the size and weight problem is the small air flow of an engine like the T63. Maximum air flow on the T63 is about three pounds of air per second. A large turbojet, such as those on commercial transports have air flows of more than 150 pounds of air per second in most cases. It is very difficult to move the T63's small air flow efficiently. In addition to the low air flow, the small size of the engine parts creates many problems during development. Allison, for instance, had to deveop new strain measuring devices to provide an accurate picture of the internal workings of the T63. On larger engines of 500 shp and over it is possible to employ conventional instrumentation that has been used for years in jet engine development.

Now that the T63 project is three years old and the engine's basic capabilities in its present configuration are known, a major installation change has been requested. All of the airframe contractors on the LOH aircraft want to turn the T63 over so that the air intake is above the output shaft. This leaves the inlet in a free and uncluttered area on all of the LOH designs. When the engine is turned over, the principal changes required are in the oil scavenging and breather systems.

A brief summary of the T63 development schedule from the contract award through the weight adjustments and the projected delivery of flight engines follows:

June 1958—Contract award. April 1959—First run of the type I engine weighing 95 pounds for the turboshaft and 110 pounds for the turboprop versions. Feb. 1960—First run of the current model weighing 128 pounds in the turboshaft configuration. March 1961—Fifty hours conditional Preliminary Flight Rating Test (PFRT). July 1961—Official PFRT. About 1,600 hours of total time on development engines at this point. January 1962—Delivery of first inverted engines to LOH contractors for ground test and familiarization work. February 1962—Official PFRT on inverted engines—estimated total time on development engines 2,800 hours. May 1962—Deliveries of flight type engines to LOH contractors. August 1962—150 hour qualification test of inverted engine. November 1962—Delivery of 150-hour qualified engines to LOH contractors.

MANY of the ground tests now being performed with the T63 involve running the engines in extreme attitudes, to insure that the lubrication and fuel systems will function properly during maneuvers. Specifications call for a capability of starting and stopping at any pitch attitude from 75 degrees above the horizontal to 25 degrees below, and rolled to either side to 20 degrees. It must also operate continuously from 75 degrees above horizontal to 45 degrees below.

A large number of the ground tests are involved with power transient investigations, to insure that the engine will accelerate rapidly and smoothly under all conditions. The engine system which controls these transients consists of two gov-

(Continued on page 90)

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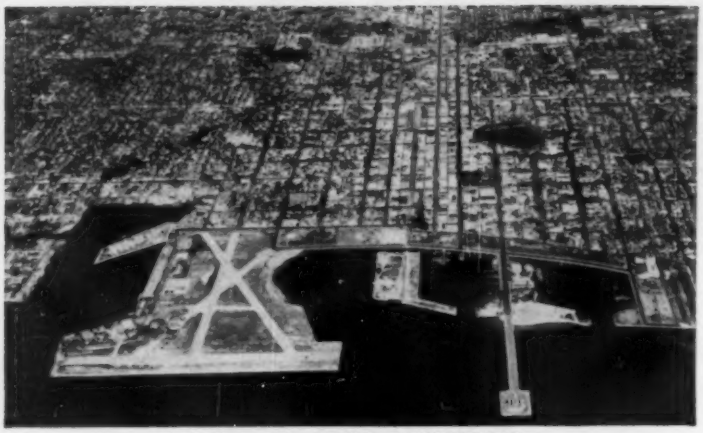

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(Continued from page 88)

errors. One controls the rpm of the gas producer turbine and the other controls the rpm of the power turbine. In helicopter operations the gas producer governor is strapped down at its maximum setting of about 48,000 rpm. This provides in effect an overspeed control. The pilot is then able to operate the engine through one lever, the power turbine rpm control lever. This lever then completely controls both the fuel flow to the engine and the output of the power turbine and the reduction gearing system.

Other ground tests simulate typical combat missions complete with the takeoff, landing, cruise, high power operation during combat situations and emergencies. A total of about 200 hours per month is being put on the test engines.

At the moment the tests are proceeding well. Major performance requirements such as a specific fuel consumption of .71 lb./hp/hr. apparently will be met. But many months of development work lie ahead before the T63 will be ready for its first exhaustive flight tests in LOH helicopters. According to Allison officials many more months will be required before the engine is ready for the lightplane market. END

I Learned About Flying

(Continued from page 70)

begin to settle, and started to counteract it with throttle. The next instant, we were rolled violently to the left, past the vertical. The controls were totally unresponsive. A moment later we were in a partially inverted position plunging earthward. The outcome appeared certain and fatal. The thought flashed through my mind that there must have been structural failure. Eternity was a split second away when, with throttle full open and prop screaming in near flat pitch, I felt the ship begin to respond to the controls. Much to my surprise, we rolled out level with still 75 to 100 feet to spare. The air was extremely turbulent and it was difficult to keep the ship under control, even with full throttle. But after a few moments we managed to retract flaps and gear and return to normal flight.

It was simply impossible to accept what had happened. We circled and climbed back to 2,000 feet and approached the same area at normal cruising speed—almost at once the ship began to go out of control in the same manner with a violent roll. We made a diving turn and flew back to Hillsboro some 15 miles away and landed.

Later our daughters said there had been a light gust pass over the field as we were starting to make our approach. There was no thunderstorm activity and by the time we had driven home from the airport at Hillsboro an hour later, the weather was still calm and appeared the same.

I'll stop for coffee and pie more frequently in the future, and keep closer tabs on approaching fronts, no matter how weak the man in the weather bureau says they are. I also learned that accidents can happen where the causes (such as stalls on final approach) appear simple. If the pilots were still around, I'd bet some startling revelations would add to man's knowledge of the air. END

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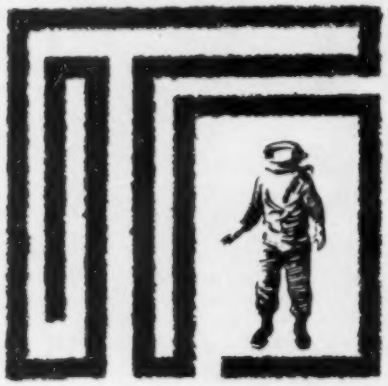

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BREATHING LIFE INTO AIR AND SPACE TRAVEL

North American

(Continued from page 53)

Germany had studied the initial months of air war in Europe and formed opinions as to what fighter performances would be essential to dominate combat in days to come.

So, when the British Air Ministry, in February, 1940, proposed that North American build Curtis P-40s for them, "Dutch" countered with the proposal that he build them a fighter of his own—something for tomorrow.

Already experienced with North American's design and engineering integrity, the British agreed, and in May, 1940, the drafting of the P-51 was begun. Four months later, Sept. 9, 1940, the first Mustang was completed and began tests at Mines Field. A year later, the RAF had it in combat where its laminar flow airfoil, clean lines, and low frontal area gave substance to Kindelberger's vision.

IT is no part of our intention to detail the career of the fabulous Mustang family—its adaptations to high level, low level, attack bombing, long range or reconnaissance demands. Powered by various Allisons or Packard-built Rolls Royce Merlins, spinning a variety of props, three bladed, four bladed, five bladed, armed with a variety of guns, 30 cal., 50 cal., 20mm cannon, or rockets and bombs in many different combinations, it fought its wars from Berlin to Tokyo, outclimbing the Focke-Wulfs and Messerschmidts in Europe, and cruising from Iwo to knock down Zeros and strafe in the Pacific. Its destiny eventually overlapped the advent of the jets in Korea, and it saw post-war service in many free Air Forces, Australia, South Africa, France, Italy, Switzerland, Nationalist China among them. A total of 15,575 Mustangs were built around this first laminar flow applications of Kindelberger's.

The vision to have The Texan, Mitchell, and Mustang, North American's trinity of star performers ready for their roles is to the credit alone of North American. There had been scant encouragement by the Government. Between WW I and WW II, less than a tenth of the total defense budget had been spent for airpower! President Franklin Roosevelt's demand on May 16, 1940, for 50,000 aircraft in service, and an annual production of 50,000 planes thereafter, would have been a mockery had the hitherto unsupported preparation of such as North American been less. At the time of that demand, Army and Navy together had only 4,700 aircraft, the majority trainers! The 1940 budget, moreover, called for only an additional 156 units. Yet, already North American's farsighted commitment to defense exceeded its capitalization by 25 per cent; and this without a dime of government guarantee!

North American had begun its career in an upsurge of military interest, but even at that, foreign sales prior to 1940 exceeded domestic—not much background of patronage to inspire preparation for responsibilities soon to be thrust upon it.

Now, let us sketch the company's quantative evolution as an industrial giant.

Factory space at Inglewood utilized in 1936, averaged 141,000 square feet while employment averaged 652. Eighty-two trainers were produced with eight per cent of the work subcontracted—a firm percentage until mid-'41. Space and payroll was progressively added until in January '40, the figures stood at 424,000 square feet and 3,488 employees.

A total of 212 trainers were sold in '37, three dozen of them abroad. In '38, production rose to 401 planes. 324 trainers and 77 observation craft, of which 99 trainers went abroad. And mark 1939! Of 793 planes manufactured, 639 were exported!

Expansion at Inglewood bounded in '40—factory space to 800,000 square feet and employees to 8,289. Of 1,230 aircraft sold, all but 32 were trainers; and again exports led the market, 684 to 546. Thus far, North American had wholly financed itself.

In May, '40, F. D. R.'s belated trumpeting for airpower implied expansion beyond the financial ability of any company. Government financing was invoked for plant construction. Huge factories were thrown up and leased to aircraft manufacturers by either the Defense Plant Corporation or the War Department. Ultimately, 74 per cent of North American's working area was of this origin. Initially the company had two items of critical priority in building airpower—the AT-6, and SNJ, and the long-range medium bomber, the B-25.

By year's end, government was erecting steel for a million square foot plant at Hensley Field, Dallas, for lease to North American in behalf of trainer production. An advance cadre from Inglewood moved into the uncompleted plant in Jan. '41, and on April 7, three AT-6s rolled out—vanguard of the thousands to follow.

Almost simultaneously a similar inland plant was going up at Fairfax Field, Kansas City. Another Inglewood advance guard moved into this likewise unfinished factory, and on April 23, '41, the first three B-25s were ready. KC led the world in medium bomber output.

The KC plant was one of those involved in a Knudsen inspired plan to use the capability of the automotive industry for manufacture of aircraft parts and sub-assemblies which would then be shipped to aircraft builders for final production. Other plants in this plan were those leased to Douglas at Tulsa; Consolidated at Forth Worth; and Martin at Omaha. Each aircraft company had an automotive partner. North American's was General Motors.

MEANTIME expansion of similar proportions under government financing was going on at Inglewood. We will not tax the reader with detail of this and subsequent expansion at Dallas and Kansas City except to note that at peak production North American was utilizing two and a half million square feet of factory area at Inglewood, almost three and a half million at Dallas and two and three quarter million at Kansas City. Subcontracting reached average levels of from 13 to 15 per cent.

From Jan. '39 to VJ Day, '45, North American produced approximately 14 per cent of the industry total of units. As Dallas was meeting its trainer quotas, the division was also producing B-24G and B-24J Consolidated Liberators and P-51C, D, and K Mustangs. Inglewood's total of war production, 17,474 aircraft was divided in three

(Continued on page 94)

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UNITED

(Continued from page 92)

categories, some 4,000 trainers, 3,200 Mitchells, and 10,000 Mustangs.

To enumerate the problems of wartime expansion and production is no part of our intention. Draft Boards with scant overall perspective took experienced employees until Kindelberger had to ask, "Does the Government want soldiers from aircraft plants more than it wants airplanes?"

Jurisdictional union quarrels plagued production schedules. One Commie inspired wildcat strike at Inglewood while Stalin and Hitler were still pals, became a labor scandal. The Roosevelt administration, catering to the labor vote, consistently had the thumb screws on management.

Training of more than 80,000 novice employees almost overnight seemed impossible, but Kindelberger hit on the idea of teaching each individual to do some one single chore and repetition of that chore produced experts at it. Large scale production made this possible.

Finance for working capital was eventually solved. Loan credit with a combination of banks replaced unsatisfactory government "prepay."

Fantastic labor turnover was a headache. Employee housing and transportation under gas rationing was another. Control of the accident rate on production lines was a "must." Modifications growing out of combat requirements disrupted schedules. Intermitted material shortages required constant shifting of manpower.

Bond drives, public relations and a myriad extra-curricular activities drove management to bone weariness. The Press called the performance of the aircraft industry a miracle.

And the elements of a miracle were there all right but it wasn't the one they were talking about. The miracle was that in the midst of the whole vast involvement of of WW II with its pressing absorptions, "Dutch" Kindelberger and his confreres foresaw that this was not a climax of airpower but only an introduction . . . a portal to the stars which would involve men and nations, knowledge and science in rivalries undreamed of and in conflicts undefinable.

Jet power, rocketry, radar, nuclear warheads, inertial guidance systems and kindred scientific advances had begun to come into focus. Educated imagination could foresee breaking of the sound and thermal barriers; could envision horsepower harnessed by the millions; could calculate thrust into space.

End of war would, for a time, turn the world over to politicians, ideologists, junk dealers; but they had never won wars or made lasting peace. There would be deadly rivalries as always—aggressors as usual. And this time the vulnerabilities would be magnified—the purchase of preparation time an impossibility.

The responsibility of Kindelberger et al at North American was to adjust to the postwar production inertia without sacrifice of the capability that had been organized, the staffs which had been coordinated. Breech had resigned as Board Chairman in '42 to take over at Bendix but otherwise the "old guard" was largely intact and supplemented by a brilliant cadre of scientists, engineers, managers, test pilots, planners.

How the book was closed on one era and opened on another will be the subject of our next article on North American, Industrial Giant of the Air Age.

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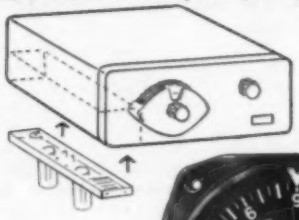

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Aviation Fuels

(Continued from page 45)

and 115/145. They can be identified by their color from the dyes added to them. Grade 80 is red; 91, blue; 100, green; and 115, purple. At least this holds true outside the Iron Curtain countries. Russian gasolines, like politics, have a different color from the rest of the world. Their 100/130 grade, for instance, is orange instead of green; and their 115/145 grade is red instead of purple.

But in all parts of the world numbers up to 100 refer to octane; above 100 to performance numbers. The first number of each pair indicates the rating at lean mixture conditions (during cruising) and the second the rating at rich mixture (climb and takeoff). The term octane number comes from a hydrocarbon compound known as octane which has a high anti-knock value and is used to measure the anti-knock value of fuels.

Fuel grade 91/98 is on the way out. According to suppliers, the demand for this grade has dropped very low, and it is being eliminated to reduce the cost of handling too many grades of fuel. Former users of 91 octane fuel are being directed to use 100/130 grade.

What would happen if you tried to use automotive fuel in your aircraft? Quite possibly the octane number would be too low and serious engine damage could result. Because of the different vapor pressure—that of auto gas is usually higher—vapor lock might occur—and engine failure.

Vapor lock occurs when sufficient fuel vaporizes in the fuel system or carburetor to interfere with the normal flow of the liquid fuel.

Also, the volatility of auto fuels differs from that which gives best performance in aircraft engines, and the gum stability is not as good. High-gum fuel may cause sticking of intake valves or cause deposits during storage.

In general, the chemical composition of the two fuels is quite different, and much more stringent control of auto gasoline would be required to insure the uniformity and necessary qualities of avgas for flight safety.

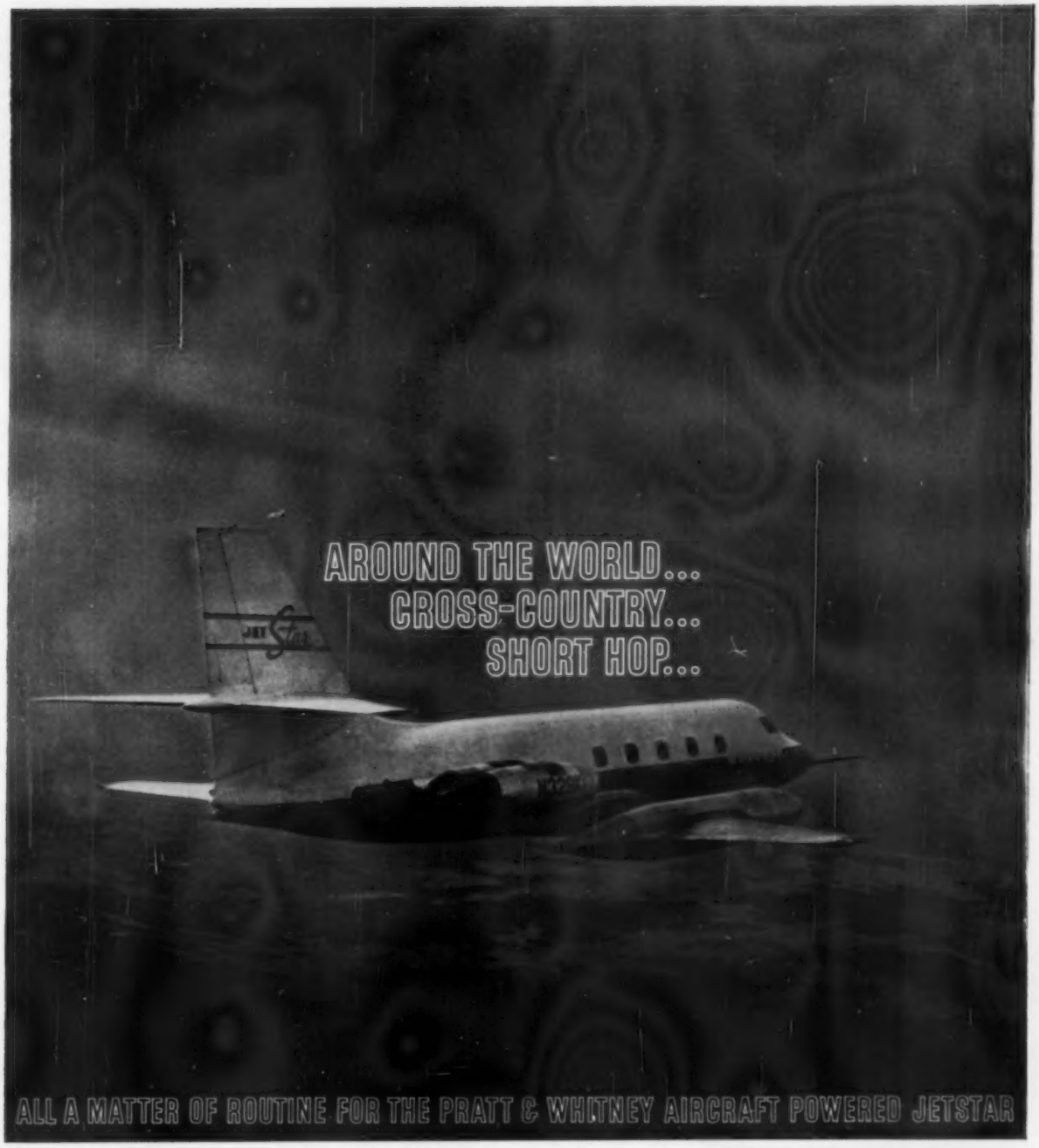
So you've got a tank full of avgas, and you're all set. Or are you? How about the octane number? Your aircraft manual says which octane fuel your engine is designed to handle. Can you vary from this if you sail into a field that doesn't have your grade, and if so, which way, up or down?

A fuel's octane number is merely an indication of its ability to burn properly in an engine without knocking. The better the anti-knock value of a fuel, the more air it enables an engine to burn, and the more power it will produce, provided the engine is designed for it.

By the same token, an engine of a given size using a high octane fuel can turn out as much power as a larger engine burning a low octane fuel. The better the fuel, the smaller the engine.

Esso Standard Oil Co. notes a vivid example of the progress in aircraft engine development made possible in part by improvement of anti-knock value of fuels—a comparison of the Liberty engine of WW I

(Continued on page 98)



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(Continued from page 96)

with the Rolls-Royce Merlin of WW II. Both engines were liquid-cooled and had exactly the same total cylinder displacement of 1,650 cubic inches. The Liberty engine delivered 420 hp at 1,700 rpm and weighed 2.16 pounds per horsepower. The Rolls-Royce engine delivered 1,700 hp at 3,000 rpm and weighed only 1.04 pounds per horsepower. That represents more than four times the power of the Liberty engine with less than half the weight per horsepower.

Knock, or detonation, is not something that can be heard in the aircraft engine as in the automobile motor, but nevertheless it rapidly can cause serious damage.

In normal combustion, the flame ignited by the spark progresses smoothly across the combustion chamber. It should never explode instantaneously. With a low anti-knock quality fuel, however, the pressure and temperature become too great for the fuel to withstand. And instead of continuing to burn smoothly and evenly, the last portion of the mixture explodes violently and almost instantaneously. This uncontrolled explosion is called fuel knock, or detonation. In an automobile engine you can hear it as a click or pinging sound.

The explosion occurs so quickly that some of the energy is wasted as heat because the piston can't move down fast enough to absorb the pressure as work or power. That's why a knocking engine overheats and loses power.

Major damage can result. Heavy detonation is followed by serious overheating which can melt pistons and cause burning of valves, bending of connecting rods and sticking of piston rings. It can also lead to pre-ignition, which is spontaneous ignition or burning of the fuel prior to its firing by the spark plugs. Pre-ignition causes severe power loss and may cause particularly destructive overheating.

SO, if the correct octane is not available, use a higher grade—the next higher one for economy—but never a lower one. High octane fuel won't burn hotter; if anything, it will burn cooler. And in some localities, such as Nassau in the Bahamas, a higher grade such as 100 octane may actually be cheaper than 80 octane because of availability.

A factor to take in consideration, however, if higher grades are used over a long period of time, is that they usually have a slightly greater content of tetraethyl lead (TEL). This means that more attention may have to be paid to spark plug maintenance because of lead deposits.

At any rate, it pays to be alert to the octane fuel your aircraft receives on the flight line, especially at a strange airport.

Mechanics note that engine damage by detonation because of improper octane is frequently traced to the student pilot on cross-country who allows his aircraft to be fueled with too low an octane avgas. Assuming the line attendant will know the correct octane for your airplane is asking for trouble, especially at small fields where temporary help is recruited to handle heavy summer and fall traffic.

So now you have the correct grade of fuel for your aircraft. But how you operate the engine and the conditions it is exposed to will determine whether it works satisfactorily and gets full value from the fuel.

A common cause of detonation is improper fuel mixture. Even if the right octane is used in an engine, incorrect leaning can create temperatures beyond the anti-knock capability of the fuel. In one instance noted by Gene Coughran, vice president of Island Airmotive, Inc. at Zahn's Airport in Amityville, N. Y., the automatic mixture control on a Twin-Bonanza had been maladjusted, giving too lean a mixture.

The resulting heat and detonation burned a thumb-sized hole in one piston and pitted the faces of the others. The engine failed at the critical point—just after the pilot had taken off. His other engine brought him back to the field safely, however.

Over-lean mixture settings by the pilot, himself, also frequently cause detonation damage. This is especially likely to occur when the pilot forgets to richen the mixture on descent from cruising altitude.

THE lead (TEL) used to combat knock may also turn out to be a mixed blessing and may itself impair the efficiency of the engine by causing lead fouling on spark-plugs and in combustion chambers. Lead deposits are conductive and can short out the spark plug, preventing it from firing properly.

To prevent formation of lead oxide during combustion, a scavenging agent (ethylene dibromide) is added to the fuel. This agent converts the lead oxide into lead bromide, which in turn is more volatile and has a greater chance of being removed from the cylinder as a gas.

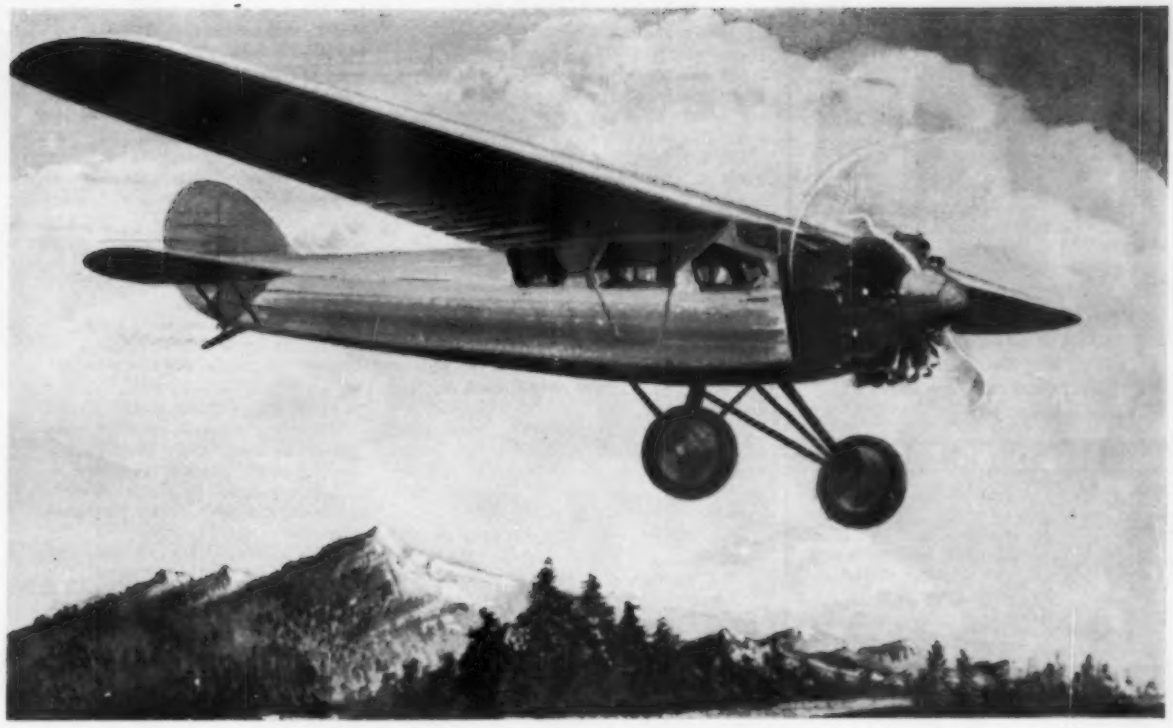
And although this greatly cuts the amount of deposits formed at higher temperatures during high-throttle operations, it is not sufficient to prevent deposits occurring at lower tempertures in the engine, such as during idling.

The lead content of a fuel has a great deal to do with the degree of TEL contributing to spark plug fouling. The 80-octane fuel by specification has less than one cubic centimeter of TEL per gallon. But 91, 100 and 115 can have as much as 4.5 cc per gallon. Therefore lead fouling difficulties might be alleviated to some degree with lower leaded fuels of the proper octane (the specifications set a maximum lead content, and actual content varies in different fuels).

But though lead content is a direct factor in lead fouling of spark plugs, poor distribution of lead is an even more significant one. The design of an engine induction system can cause the quality of the fuel mixture received by each cylinder to be different, and maldistribution of the lead can result. The reason for this is that the TEL distribution doesn't necessarily follow the distribution of the fuel.

The main cause for this is that TEL has a lower volatility than that of the fuel. What happens is that fractionation of the fuel, (separation according to differing boiling points) occurs in the induction pipe, leaving unvaporized portions rich in TEL. These lead-rich residues may go entirely to one or two cylinders, depending

(Continued on page 100)



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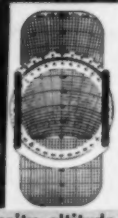

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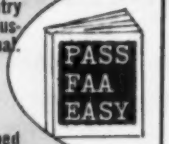

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(Continued from page 98)

on the geometry of the inlet manifold. These cylinders will receive far more anti-knock compound than they should, while others will be short-changed. The scavenging agent, having greater volatility, boils away and fails to follow the TEL.

Engine operation temperatures which result in low mixture temperatures, such as high altitude cruising at low engine speeds, heighten maldistribution. Also excessive ground running, particularly idling at low outside air temperatures, will cause maldistribution of TEL.

The formation of carbon deposits on spark plugs is also accelerated by idling the engine excessively. This is especially so when the fuel/air mixture is too rich at idle power because of an incorrect mixture setting.

One method of combatting spark plug fouling, Champion Spark Plug Co. notes, is design of spark plugs to permit greater scouring of components by cleansing combustion gases.

These gases cut away deposits on the core nose.

The fuel injection engine (See FLYING for May) also does away with induction system maldistribution problems by metering the correct and balanced mixture to each cylinder.

Another kind of harmful spark plug deposit can occur in operations from undeveloped fields, in desert areas, or wherever dusty conditions prevail.

Lead oxide digests silica or dust, and the resulting lead silicate will short spark plugs. The combining of the silica and lead oxide is, however, a very slow process and may take as much as 20 to 50 hours of engine operation. So an engine may take in dust but not experience lead silicate fouling until several days later.

Aircraft such as crop dusters and helicopters operating from temporary undeveloped fields are particularly susceptible to spark plug fouling of this type.

And no known clean-up procedure will get rid of lead silicate deposit once it has been formed. Aircraft operated in dusty conditions therefore should be fitted with adequate air inlet filters to prevent dust ingestion.

Part II of this series, Turbine Fuels, will appear in the November issue.

Unreliable Lake

(Continued from page 59)

parachutes, and quickly summoned an RCAF Dakota. The Canadian "Gooney bird" soon established radio contact with two separate survivors on the ground. One was Col. McGrew the other Capt. Epton. Both needed help. Para-medics jumped to the aid of McGrew and Epton.

In seven hours, Col. McCrew had been returned to civilization, and Capt. Epton made safe and comfortable.

The search went on for Maj. Dowdy and Capt. Pittman until darkness came down over all the northlands.

At about the time Col. McGrew was being returned to safety, I left Lowry Air Force Base as navigator of a Grumman SA-16, amphibious search-and-rescue plane of the U. S. Air Force. Stopping overnight at Winnipeg, we reached The Pas at noon of the second day of the search.

That afternoon, flight crews returning from the search area told us of the difficulties they encountered, factors that make rescue efforts in the far north different from all others. Even greater than the battle against the elements was the navigation problem. That part of Canada has never been thoroughly and accurately mapped, and the aerial charts were obliterated by snow, and magnetic disturbances affected compasses and radio beams.

Faced with these problems, navigators were drawing in prominent checkpoints on their maps, and locating these by their own reckoning. One checkpoint was used above all others for orientation. It was nothing more prominent than a frozen lake covered with snow, its outline standing out against the evergreen forests that surround it. Except for an accident of map-making, it too might have remained forever obscure, but the word UNRELIABLE, printed in bold relief across the face of the chart, touched that lake, and gave it a name quickly adopted by all of us. Lake Unreliable, just over the Saskatchewan border 110 miles northwest of The Pas, became the only reliable checkpoint in that part of Canada.

Early the next morning, the first American helicopters arrived. Flown by veterans of Air Rescue in Korea, the Sikorsky H-19s gave a new phase to the mission. Here was the means to fly land rescue technicians to the fuselage and lower them down into the wreckage itself.

That morning we were assigned to escort one H-18 to the site. This we did, flying slow circles around the whirleybird, giving it directions and positions as it chopped its way toward the hulk of what had been one of the mightiest airplanes in the sky. The terrain below was a confusing mosaic of unnamed lakes and forests that stretched virtually unbroken for a thousand miles in every direction. I memorized what checkpoints there were.

Slowly the shape of Unreliable Lake came into view. Just beyond, lying in the clearing, were two dots that soon became identifiable as parts of the B-47.

As the H-19 hovered over the scene, a rescue technician was lowered on a power-operated hoist. He carried a crash axe with him, and began the back-breaking job of cutting into the hull. Hours passed while the chopper hovered and our plane flew in tense circles nearby. Then suddenly the VHF cracked with a message from below. The rescueman had reached the nose, and discovered a body. He identified it as the navigator, Maj. Dowdy.

There was no sign of Capt. Pittman, and the search went on. The H-19 had to return to the base for fuel. Our airplane was assigned a search pattern, and spent the next four hours combing the woods at low altitude. All we saw were herds of moose.

Then darkness came again, and the crews returned to the twinkling cluster of lights that was The Pas. Each crew refueled its own plane from large gasoline drums lying in the snowbanks at the end of the parking ramps. Then we ate flight rations and fought our way through blasts of wind-driven snow to an unheated, unfurnished shack where we bedded in sleeping bags.

(Continued on page 102)

TIME: 1200 . . . DATE OF THIS TEST? SOON . . .

. . . AND YOU'RE A PART OF SOMETHING LIKE THIS!

The day the first Minuteman missile train will roll down the track is unknown today. But the men of the Air Force who will be part of that first crew are preparing themselves right now. Of course the Minuteman represents only one Air Force project designed to make our country supreme in the air and beyond. But complex and diverse as these air and space projects may be, there is a common ingredient they cannot do without . . . men with training.

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THERE'S A PLACE FOR TOMORROW'S LEADERS ON THE AEROSPACE TEAM **U. S. AIR FORCE**

(Continued from page 100)

Far out in the Arctic night the wolves howled, the wind whistled, and the temperature dropped to 38 degrees below zero. Tossing restlessly in my sleeping bag, I kept thinking of Capt. Pittman, wondering if he were still alive, and if so, how he could manage to survive such nights as these, alone, unaided, probably injured.

Chances of finding Pitman seemed quite remote.

The next morning even the weather was working against us. The temperature remained low, and the wind lashed against men and planes, but the real enemy was the ceiling of grey stratus clouds settling at tree-top level.

Again my crew was assigned to navigate for the helicopter, and as we pushed into the slate-grey daylight and gathering clouds, it rose vertically behind us, chopping along like a monstrous iron hawk. Our aircraft turned to 325 degrees, and we levelled at 500 feet.

The weather was closing in rapidly, and the ground disappeared for long periods at a time. I was navigating by instinct, calling on everything I had ever learned. Finally, almost by accident, we spotted Old Unreliable. A few seconds later, on a heading of 326 degrees, the fuselage came into view. At this moment, we banked to the left to talk to the helicopter crew. Watching the needle, I saw it swing past 270 degrees, reach 250, and swing back.

By now compass and instrument readings were meaningless. The plane was in a steep bank. I glanced through my small plexiglass porthole at the dizzy whirling of the blurred terrain. Suddenly, for a fraction of a second, I saw a dot of red. Then it was gone.

Reacting by reflex, I pushed the "call" button on the intercom.

"Pilot from navigator! I just saw something."

"What was it?"

"I don't know. We were banked too steeply and flying too low. But it was something red."

"Can you find it again?"

Another look was impossible, the ceiling had dropped too low. All we could do was climb into the clouds to a safe altitude and hope the weather would break.

Four long hours passed by as we flew circles overhead. All that time the flash of red I had seen stayed with me.

It was early afternoon when the weather broke up enough for us to see the ground again. By then we had drifted miles away, and before we could do anything else we faced the complicated task of finding our way back to Unreliable. Sometimes, however, there is more to aerial navigation than science; you have a feel for your position, a hunch about which heading to fly. At last out of the wilderness the familiar outline emerged. Tracking out 326 degrees we saw the B-47 fuselage, and this time another landmark. The helicopter crew had landed and chopped out a clearing for themselves. Land rescue technicians, cutting into the broken fuselage with acetyline torches this time had positively determined that Pittman was neither in nor under the airplane.

We advised the H-19 crew that we were back in the search area to look "for something red."

"If you actually saw anything at all, it was probably only signal panels laid out on the ground by our own land parties," the helicopter crew advised us.

"Okay, then," I said, "point these out to us and we'll take a look at them first." As the helicopter rose vertically before us I tried to remember just what it was I had seen, so I would have something for comparison. With the H-19 leading us, I carefully examined every panel. None of them looked like that thing I had seen so briefly.

That tiny blur of red upon a dizzy, spinning earth could be but one thing: the parachute of Capt. Pittman.

To find the little spot of red another time, we had to go back to the fuselage and recreate a hastily performed, accidental, unplanned maneuver of four hours before, and fly it with almost impossible accuracy.

There are times when every detail assumes over-powering importance. The first of those was that compass needle, leaving its heading of 326, swinging past 270 to 250, stopping its sweep, pausing for an uncertain, suspended moment of time, then starting back. Through what gyrations the plane must have gone, over what terrain

(Continued on page 104)

FLYING FAMILY

NO LONGER will it be, "Drive carefully, Dear," when salesman Don Lynch leaves to make his sales rounds. It's more likely to be, "Don't forget the carburetor heat," or "Don't forget to put the gear down." And it may be that when Don's two teenage daughters don't entirely agree with his dictums, you'll hear a muttered, "Aw, Dad's got his flaps down again."

The reason for this aeronautical turn of affairs in the Lynch family is that father, mother and both daughters soloed on the same day recently. It all started when Garwin, Inc., aircraft instrument manufacturer of Wichita, Kansas, offered to pay for flying lessons for all sales employees.

This didn't sit at all well with Mrs. Lynch who admittedly, "Worried myself sick every time Don even traveled on the airlines. Flying himself around over the country was more than I could bear to anticipate." But never underestimate the power—or intelligence—of a woman. Realizing that such anxiety could eventually lead to health problems, she decided to investigate this lightplane flying for herself. One lesson was all it took to make her a confirmed addict, and she had a week of lessons before husband Don even found out about it.

Mother's successful experiment led to asking the two daughters, Carol and Connie, if they'd like to take lessons. The offer was quickly accepted and led to the family's en masse solo.

Mrs. Lynch is progressing more rapidly than the rest of the family. "She sneaks off during the day," reports Don, a little jealously, "while I'm working and the girls are in school. She's picking up a lot of cross-country time by going with our instructor, when there's room, on charter and delivery flights."

The entire family is going through ground school together by using the Sanderson Sound-slide film course. With this system they are able to study at home and at their own pace. It appears to be one course of study that the two Lynch high schoolers never shirk.

"This flying had better increase my sales effectiveness as they say," Don grins. "This is one family expense I never dreamed about."

NORMAN JACOBSHAGEN

How Clean Is Your Fuel?

Even the most forgiving airplane can turn nasty if its gasoline diet gets contaminated with water, dirt particles and other non-combustibles. Perhaps you know and observe the precautions necessary to avoid fuel contamination in your plane. But, in the interests of safety, let's review the basics:

DRAIN FUEL SUMPS. Notice that plural: sumps. On your pre-flight, it pays to drain a few ounces, not only from the main gascolator, but from the wing tanks themselves. This gets rid of moisture and sediment that accumulates on the bottom of the tanks and does *not* get cleared out through the gascolator. (Quick-drains are now available as an accessory for most light planes that do not already have them.)

TOP YOUR TANKS. Make sure those tanks get filled *before* you put your plane away for the night. This will prevent condensation from forming on the inside walls of your tanks—the same type of moisture you often see on the *outside* of your plane early in the morning.

One more tip: use all your tanks. Avoid letting gasoline "sit" for month after month in an auxiliary tank. Keep your fuel "fresh."

Follow these rules and you'll help keep your plane's gasoline diet pure and healthy. Incidentally, you might be interested in knowing something about the systems your Gulf aviation dealer uses to insure delivery of absolutely clean Gulf aviation gasoline into your plane.

Notice another important plural: systems. That's because your Gulf aviation dealer has what amounts to *three systems* working in combination to keep the fuel pure. Here's how they operate:

WATER-LOCKING FOOT VALVE. This is a special safety device installed on the suction pipe in every Gulf aviation gasoline storage tank. The water-locking foot valve floats in water but not in gasoline. So, if any water were to get into the gasoline storage tank, bang! . . . the water-locking foot valve would immediately close off the suction pipe and nothing could be pumped until that water was drained off.

MICRONIC FILTRATION. This is Gulf's filtering system at the pump, and it's so effective it will screen out any solid particle down to 10 microns in size. And that's pretty small, because a micron is 39 *millionths* of an inch.

100 MESH NOZZLE SCREEN. Just in case anything should flake off inside the hose, there's a very fine mesh screen right at the nozzle. So, up to the very point at which Gulf aviation gasoline is delivered into your plane, it's being filtered, cleaned, purified.

Reassuring, too, to know that Gulf aviation gasoline is the finest quality you can buy, whether it be 80/87, 91/98 or 100/130. The same applies to Gulf's two aviation oils—Gulfpride Aviation Oil Series D, the detergent oil, and Gulf Aircraft Engine Oil, the straight mineral oil. So taxi up to the Gulf sign, for clean, high quality aviation products.

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(Continued from page 102)

it must have flown, we had to determine, and on the results a man's life depended.

As supernatural strength can sometimes come in times of panic or stress, so supernatural memories came to me. As every man fixed his attention of the ground below, I called out the headings to fly. "Track out past the tail section on a heading of 326. Hold it, hold a few more seconds—now begin your left turn. I don't know how steep . . . sort of a slipping, drifting turn. We're approaching 250 degrees now . . . now, flatten out . . . hold it a second . . . now, now . . . begin a sharp right turn. Stand it on the wing. Now, now hold it. There it is! I see it!"

Just as it had happened that first time nearly five hours before, so it happened again. An instantaneous flash of something red on the snow-covered terrain, then it was gone, lost in the dizzy blur of ground in a violent turn. But this time there could be no mistake!

We repeated the pattern again and again, but somehow, something went wrong. After that second pass over the scene, we could see nothing.

Now our pilot, Lt. Dale Harris, had an idea. "Maybe the reasons we have difficulty seeing anything is that we're in too tight a turn and too steep a bank. Let's fly the pattern a little differently, so that when we approach the target, we'll be in a flat turn with good visibility."

We planned a new approach, one that would take the airplane to the same spot on the ground, but by a different route.

This time we were successful. Even before we reached the area, we could see the red-and-white panels of a parachute—and on the parachute, as we approached was a man propped up on one elbow, waving weakly at the big amphibian.

We called the helicopter, and while it hovered overhead, a para-medic went down on the hoist, strapped Capt. Pittman in and brought him up. The H-19 flew the rescued officer to a frozen lake nearby where he was transferred to an Otter.

At the hospital at The Pas, Pittman was given medical treatment and I talked briefly with him. A smiling, weak, bearded skeleton of a man, he still clutched a small pistol with one bullet left. He had broken his leg while still in the B-47. The shock of landing had not helped it and he chewed through his parachute's nylon lines to make a tourniquet, spending four days loosening and tightening the cords. With his small pistol he shot a rabbit for food but was unable to move far enough to reach it.

We flew him to Winnipeg where he began the long road to recovery.

Today Capt. Thomas Pittman is still on active duty, one of the Air Force's recognized experts on survival.

The far northern reaches of the white wilderness are just as cold and just as barren as they were that Saturday morning in 1955. The Indian trapper goes his way; the radio operator waits by his console.

If it happens again, though, that smoke and parachutes mar the sky, the Air Rescue Service will be immediately airborne and using every trick in its trade to lift aircrews from the ground and put them back in the air.

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Swing-Tail CL 44

(Continued from page 55)

latches, and there are two warning lights in the cockpit to indicate when any of the latches is unlocked. If one of them malfunctions on takeoff or in flight, however, the other seven are designed to take the entire strain of airloads on the tail without failing.

Pressures to the servotabs that move the rudder and elevator are carried through the fuselage break by six tappet-like pushrods that engage each other when the empennage is closed. In operation, the tail is pushed open by a hydraulic cylinder at the top of the fuselage, locking when it has moved the empennage 105 degrees from the fuselage centerline. The tail, which is 33 feet long and weighs 11,000 pounds, can withstand wind velocities up to 60 mph without damage when it is open, and can itself carry 3,000 pounds of cargo. Vertical and horizontal stabilizers have individual combustion heaters for deicing.

The cockpit is surprisingly simple for a large airplane, and the mass of switches on the overhead panel belong primarily to the dual ADF, dual VOR/ILS, dual VHF communication radios, and dual HF radios. Provisions have been made for Loran and Doppler navigation systems, weather radar, radar altimeter, and IFF equipment.

At the left of the captain's instrument panel are three flight control position indicators, necessary with the free-floating controls to indicate when the surfaces are unlocked. Without the indicators, it would be quite possible to attempt a takeoff with the controls locked, since the column and rudder pedals move servotabs only, and are not restricted with control locks in place. Warning and caution lights are mounted together at the pilots' side, and an alarm bell rings in the cockpit whenever a warning light comes on.

The flight engineer's station, with adequate control of all aircraft systems, is behind the copilot's seat.

Engine start is not too complicated; boost pumps on, start selector to engine to be started, starter switch to 'start.' At 17 per cent rpm on the high pressure tachometer, the condition lever is moved to 'start.' Lightoff is monitored, and the condition lever goes to 'run' at 20 per cent on the low pressure tachometer The power lever, which replaces a conventional throttle, goes from 'ground idle' to 'ground run,' and the other engines are started. Ground power and a source of compressed air are required for the first engine to be started (usually number two), but manifold starting for the other three engines is available on some airplanes.

During starting, as in all phases of the Forty Four's operation, the cockpit and cabin are exceptionally quiet, and can be compared only to the interior of a jet passenger transport. Outside, the decibels are substantially higher, and the sound of a full-throttle Canadair on takeoff is at a level with piston-powered aircraft. The Forty Four has been approved to operate from airports that bar the noise of jet airliners.

Along with engineering test pilot Edward Coe, we taxied down the runway to

(Continued on page 106)

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(Continued from page 104)

the extreme end, nosed into a taxiway, and backed smartly into takeoff position. This reverse operation is standard procedure with narrow runways, and coupled with nosewheel steering, gives the ability to back the airplane precisely, a useful feature at loading docks.

The airplane was light, weighing only 120,000 of its allowable 210,000-pound maximum gross weight, so the takeoff was an impressive one. Thirty seconds after brake release and 2,900 feet down the runway into a ten-knot wind, the Forty Four reached its 115-knot rotation speed and was airborne. An observer standing at the end of the runway would have seen an unusual gear retraction sequence, for the double-tandem wheels fold back and up like seagull feet, to rest inverted in the aft sections of the inboard nacelles.

A steep climb angle resulted in an initial rate of climb of 3,200 fpm, which settled to 3,000 fpm at a 150-knot climbout speed. The 15-degree takeoff flap was retracted, and power came back to 95 per cent low pressure compressor rpm, METO (maximum except takeoff) power.

The cockpit felt unnaturally quiet, for the long propellers on the Tyne engines are geared at a 14-to-one ratio to turn at a sedate 1,000 rpm, and don't hurl air against the fuselage quite so forcefully as small-radius, high-rpm propellers.

The control system takes some getting used to. As in the Bristol Brittania, from which the Forty Four was developed, the control wheel has been replaced by what looks like the handlebar of a small bicycle. The handlebar feels quite stiff until you learn that it must be moved horizontally to the left and right for lateral control, rather than turned as a conventional wheel. Operated as it should be, aileron control is quite effective, as is the elevator control. The pilot new to the Forty Four has a tendency to overcontrol the airplane, which is not hard to understand, as he moves only a set of servotabs on the free-floating control surfaces, which in turn move the main surface. There are four servotabs on each aileron, and one of these is interconnected to the rubber servotabs for an aid in turning. The servotab system results in an extremely light control feel, and the Forty Four has an artificial feel system that simulates airloads on the control column and rudder pedals.

Visibility in the Forty Four is good for a transport aircraft; I could see 60 degrees aft from the right windscreen, enough to easily see the number four engine. The original side-loading CL-44, built for the RCAF, had 16 small glass windscreens, and the FAA indicated that somewhat better visibility might be required for American licensing. Commercial versions of the Canadair have seven large glass panels around the cockpit that amount to a 70 per cent increase in viewing area for the pilots. Each of the large windscreens is shatterproof and electrically heated.

We levelled at 11,500 feet, where a low cruise power setting of 72 per cent rpm gave 230 knots IAS, for a true airpseed of 315 mph. A still lower power setting of 69 per cent gave 205 knots at 11,000 feet, for a TAS of 279 mph. During the flight to

CANADAIR FORTY FOUR

Specifications:

Takeoff gross weight	210,000 lbs.
Landing weight	165,000 lbs.
Empty weight	88,952 lbs.
Maximum payload (3,250-mile stage distance)	63,900 lbs.
Cargo compartment	
Length	84 ft. 0 in.
Width	11 ft. 5 in.
Height	6 ft. 9 in.
Volume	7,225 cu. ft.
Wing span	142 ft. 4 in.
Length	136 ft. 10 in.
Height	38 ft. 7 in.
Tread	31 ft. 0 in.
Fuel capacity	12,180 gal.

Engines: Four 5,730-ehp Rolls-Royce Tyne 12 two-spool axial flow turbines; four-blade, 16-foot de Havilland full-reversing propellers.

Performance:

Takeoff ground run (210,000 lbs.)	6,800 ft.
Landing roll (165,000 lbs.)	5,290 ft.
Cruise airspeed (165,000 lbs., 21,000 ft.)	402 mph
Maximum cruising speed	415 mph
Maximum gear lowering speed	207 mph
Initial rate of climb (205,000 lbs.)	1,190 ft./min.
Service ceiling	30,000 ft.
Maximum range (10,000-lb. fuel reserve)	5,660 miles

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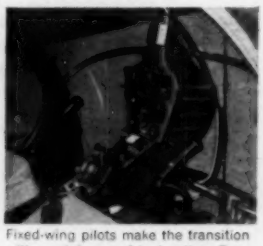

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THE COMPACT HELICOPTER

California to deliver the first swingtail to Flying Tiger Lines, Coe cruised at 12,000 to 16,000 feet, indicating 278 knots for a true airspeed of 398 mph. Never-exceed airspeed amounts to 440 mph at altitudes up to 20,800 feet, .63 Mach above that.

Advancing the power to 85 per cent, the number one propeller was feathered. Perhaps fully loaded at rotation speed and takeoff power some yaw would be noticed in the airplane, but here there was none, and no rudder pressure or trim was required to maintain straight flight. The number one engine was restarted and engines number three and four were brought back to flight idle, a zero thrust condition. With two engines out on the same side, yaw was noticeable, but still did not require an extremely heavy foot on the left rudder pedal. Half of the electrical rudder trim was sufficient to remove control pressures. Airspeed dropped to 200 knots indicated.

The de Havilland propellers do not have an automatic feathering system, but come close to it. If there is a sudden loss of thrust in one engine, its propeller automatically motors into a low-drag, coarse pitch angle. When the pilot moves the condition lever to "feather," the propeller moves to an 84-degree minimum-drag position.

During normal operation a synchrophase unit, using the number three propeller as a master, synchronizes the propellers to within one rpm.

For a fast descent, all four power levers were pulled back to flight idle, and flaps were lowered to 15 degrees. The flap setting required a substantial amount of trim from the conventional elevator trim wheel on the side of the center pedestal between the pilots. Holding 170 knots, the Forty Four descended at 1,000 fpm.

Level at 6,000 feet and flight idle, we practiced some stalls. With gear and flaps up, the stick-shaker stall warning came suddenly to life at 100 knots, and the airplane began to buffet at 98 knots. With 15 degrees flap, the stall came at 90 knots, and it took a good deal of forward pressure on the handlebar to get the nose down and recover.

I RELINQUISHED my seat to a Canadair engineering pilot and walked to the main cabin. Once again the quiet was impressive. The row of windows down the fuselage indicate that the aircraft is capable of being modified to carry passengers. Here passenger seats are bolted ten to a pallet, and the pallets are loaded aboard the airplane just as if they contained cargo. Seaboard World airlines has applied with the Civil Aeronautics Board to put a passenger top-off system into effect, flying just as many passengers as there is room for after the Forty Four is loaded with cargo. Result would be a no-frill service with greatly reduced fares. Seaboard World now flies commercially, from New York to London and Frankfort.

On final approach, with 45 degrees of flap, the airplane indicated 120 knots. It held 110 "over the hedge," as the Canadians say it, and touched down at about 100 knots. Reverse pitch stopped the Forty Four in roughly 3,000 feet and backed it around on the runway. In the parking slot the engines were shut down and the propeller brakes set.

Thirty-one of the $4.5 million aircraft have been ordered and scheduled for production to date, with deliveries so far to Flying Tiger Lines, Seaboard and World, and, later this month, to Slick Airways. The Royal Canadian Air Force bought the first 12 Forty Fours (designated CC-106), with conventional side loading doors. The Flying Tiger Line has ordered 10 airplanes, Seaboard World has asked for five, Slick Airways has ordered four. Interested, but not yet buying, are Pan American, Lufthansa, Trans-Canadian Airlines, TWA, United Air Lines, Eastern Air Lines, QANTAS, Tasman Empire Airways Ltd., KLM, and the U. S. Navy.

Of all its features, the one that sells the airplane is its ability to move cargo quickly and economically. In turn, the Forty Four's economy comes primarily from its low turnaround time, for a 400-mph airplane is not fast when it requires hours for loading and unloading. It takes one hour, plus or minus five minutes, to remove a 33-ton payload from the swingtail, compared with approximately five hours for conventional cargo airplanes. Single-point refueling and precise ground maneuverability keep down time to a minimum.

The greatest part of the loading of a CL-44 takes place in ground depots, while the airplane is in the air. Thin, special-

(Continued on page 108)

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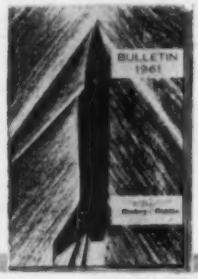

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"JUST STEER it like a bicycle. Reach up and grab the toggles and pull the right one to go right, and the left one to go left." With these words of instruction I stepped out of a Cessna 170, pushed away from the wing strut and whistled down through the blue New England sky half a mile above Orange, Massachusetts.

In four long seconds a red and white nylon canopy yanked a halt to my precipitous descent and I had become a member of a growing fraternity who made their first parachute jump at the Parachutes, Inc. Center at the New England airport.

As I cleared my ears, a ringing loudspeaker voice echoed up from close by a large white circle marked on the field. "Jumper in the air make a quarter turn to the left." A yank on the left toggle above my head, and sure enough, the chute turned—just like a bicycle. And by this novel form of GCA (ground controlled approach) the instructor guided me down to a touchdown on the marker circle.

As a former military pilot who had lugged a load of nylon for over a thousand hours and never had the occasion to use it, I was merely one of almost 1,600 who took advantage of the "First Jump Course" at Orange.

Thirty dollars and about four hours are required of the novice. Women join the men in the sport at about a one to ten ratio, and people of all ages try out their parachute wings. One gentleman of 65 is listed on the roster.

The course lasts about three hours. It includes bailout technique from a wooden mockup; falling posture—arms and legs spread and head arched back for stability; and landing technique—a tumbling roll to distribute the impact. All jumpers wear and learn how to use an extra emergency parachute.

In first jumps chutes are opened automatically by static line. Hole in the parachute (*above*) directs flow of air to the rear, actually giving forward movement for steering. Toggles vary direction of air out of the hole for turning.

As a climax to the day's jumping, veterans parachute to supper in a meadow at a nearby inn.

Approximately 13,000 jumps have been made since the May 1959 opening of the Center, which is headed by Jacques Istel and Lewis Sanborn.

DICK WEEGHMAN

(Continued from page 107)

design pallets are preloaded with freight at the airline terminal warehouse of the cargo carrier, and when the Forty Four moves its propellers into reverse and backs into loading position, all that is required is the winching out of one "train" of ten pallets and the winching on of another. Underfloor compartments can be bulk loaded or container-loaded with the aid of an hydraulic ram.

The Flying Tiger Line has begun construction of an automated loading terminal at O'Hare field in Chicago, built especially for quickest loading of their projected fleet of ten Forty Fours. When that facility has been perfected in operation, the Tigers plan to follow it with similar operations at other airports.

At more remote airports, the airplane can be loaded with conventional fork-lift vehicles, but for best utility Canadair recommends an Allen level-loader platform truck, which sets the pre-loaded pallets precisely into the winch rails of the aircraft. Used to its maximum capability, loading prepacked pallets in the main cabin and special containers in the underfloor area, the Forty Four will reach its minimum turnaround times. For the time being, however, both American operators are bulk-loading the underfloor compartments. A side cargo door just aft of the cockpit allows for an additional bulk load forward of the mechanized pallets.

Despite the size of the airplane, its performance allows it to operate from any runway that now accommodates a Lockheed Super Constellation, though its gross weight of 210,000 pounds is nearly 95,000 pounds greater than the Constellation's. In planning is the CL-44D6, with 6,445 ehp Rolls-Royce engines and a gross weight of 225,000 pounds.

Direct operating costs of conventional cargo airplanes are from eight to 20 cents per ton-mile. Transcontinental direct operating cost of the Forty Four is four cents per ton-mile, and air cargo operators are stressing that the advantages of time saved and lower shipping damages will swing the balance of favor from transcontinental trucking to the Canadair.

Asked if his company could offer serious and concerted competition with the trucking industry, one Flying Tiger, representative said, "If we can't, we're in trouble!"

The CL-44 is part of a system that can be almost completely automatic, and it handles very well as an airplane in its own right. With its dramatic reduction in cargo rates, the Forty Four is perhaps the single largest advance in the history of the commercial air freight industry. END

Around The World

(Continued from page 51)

grant permission for the overflight. They said that as long as Governor Quinn was an Irishman and this "Wings of Peace" flight represented him, no O'Pass.

Taking off into the early evening at full tanks was remarkably easy. The Super-V was an jaunty as a lightly-loaded F-86 on a scramble. At 800 feet I went back on instruments.

In long flights I stole a page from boat flying and used the step climb. This is a method where the aircraft remains as low as possible, considering weather conditions, to permit a climb at a lower gross weight.

At each stop Pan Am Commissary prepared a high protein, no-fat lunch box for me plus half a pound of pure chocolate. The plan was to space the chocolate out over the flight. The coffee was to be drunk at a rate not to have been consumed until final letdown. The need for self-gratification was so great that the pure chocolate rarely lasted over two hours. Fear has its urgencies. To look down at the gnashing sea, knowing that life expectancy is 50 per cent in 45 minutes of immersion and 100 per cent mortality in one and one-half hours, calls for some childlike head patting.

The oxygen programming was set up for five minutes every half-hour.

Off in the hazy distance I saw Kilkee and the cliffs of the Emerald Isle. The countryside "greened" up as the sun rose. Little sparklings of dew rose with the day.

Dignitaries were at Shannon Airport. Everyone in Ireland has a pure Irish name —O'Reagan, Callaghan, O'Reilly, Sullivan— as if Smith and Jones and Walker were outlawed.

Honolulu was called and an apple-cheeked, red-haired colleen sent Hawaii a Gaelic greeting. She was given a KPOI bumper sticker and spoke again to KPOI in Gaelic. When asked to translate she said: "It means, 'Rots of Ruck!' "

Flight time to Rome was 7:30. Originally the British Aero Flying Club had planned to meet 17 Bravo over Strumble, on the west coast of England, but they were unable. As the Wings of Peace flight was falling behind schedule, the London stop was scratched.

Over Cherbourg I encountered a murky sky. Feinting left and right failed to yield a chink in the sky's armor so we plunged into the white embankment. Over Paris I was unable to make contact with Paris Control, not unusual in France. Communication is difficult, French-style, like trying to upswim Niagara Falls.

The sun dipped into the west as I broke into the clear over Dijon. Off to the left was Mont Blanc, an inverted sugar cone dipped in marshmallow. Clinging about it were lesser mountains and deep-cut gulleys. The engines sang like the angry buzz of wasps as the afternoon darkened up into poetry and inexplicable beauty.

Over Nice, Marseille Radio came into life. I left the stucco-housed, wide-streeted city and moved over the Mediterranean. To the right was the island of Corsica, both Napoleon's and mine.

As I descended, the realization of how little I knew about light aircraft then, and

(Continued on page 110)

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(Continued from page 109)

perhaps now, haunted me.

It was early in the evening when I hit the runway at Rome's Ciampino Airport, after again leveling off too high. It was my cross to bear; airline training hung like an albatross. It is much easier for a well-schooled lightplane pilot to advance to airline equipment than for an airline pilot to make the transition to light aircraft. To me, an airline pilot making the transition to a lightplane is more hazardous than a private pilot making a checkout.

At the ramp were the mayor of Rome, deputy premier, and the emissary of the Pope. After the ceremonies, the emissary of the Pope, Father Polo, put on his alb. He lit two candles while an assistant held open a book. I stood in the crotch of the Super-V as he said a litany in Latin. He blessed the aircraft and prayed that it would find success in bringing understanding around the world, no matter how small. In the background deep-throated engines made up the a cappella chorus, fragmented with the mellow giggles of well-wishers. After the service, Father Polo presented me with 25 St. Christopher medals from the Pope. Though Father Polo was not aware, I was wearing seven medals given to me in quiet moments, from dirty wallets, wet hands, in handclasps and in envelopes.

Rome was the last stop at which poi was a part of the ceremony, for it was not making friends for Hawaii. Leis were presented to the Deputy Premier. He had a fine head, I thought, Roman of the best period. He sniffed the orchids and furrowed his brow. What he did not know was Pan American flew fresh leis to me at strategic points. After landing a small man in white would come around the side of the aircraft. As I extended my hands, in them he would place a box of crisp vandaleis.

In the wisdom of planning I had dropped off a manual in Shannon to be shipped back to me in San Francisco. In my strip tease, I had dropped a chart needed for the Beirut segment. When Father Polo heard of this, he grabbed my arm and towed me along. He moved as if in a walking race. We burst into the Alitalia airline office where a crew briefing was taking place. Father Polo struck the desk with his fist. All hats were doffed with astounding one-sweep motions. He demanded the chart. After much opening of cabinet doors, rustling through papers, unward palm signs indicated dismay and regret.

FROM there we trotted to SAS, KLM, BOAC, and finally, Ciampino Operations. We were informed the airport commandant had the elusive chart. We rushed into a red brick building. Father Polo thrust open a mammoth door and dashed into a red-carpeted room where four men were seated around a heavy oaken table in eloquent silence. Upon seeing him, they jack-in-the-boxed to their feet. He angrily ordered the commandant to give him the chart. Frenzied scattering finally produced the chart. Father Polo handed it to me with a head pat. He said nothing to the men who sat down slowly. We wheeled around and walked out.

After a bowl of soup, I was ready to go. The flight to Beirut was 7:22. It was overhead Athens, Cyprus, Rhodes, and then to Beirut. The nocturnal weather was lazy hot. A light breeze wafted the sea.

Fifty miles out, Beirut could be seen for a clear descent shot.

There I was met by dignitaries and made presentations. An olive-skinned man to whom I gave a KPOI bumper sticker said he did not have a car but he had a camel. Somewhere, loping in the Cedars of Lebanon, must be a camel with a KPOI bumper sticker pasted on his bottom.

At every stop a U. S. embassy official was waiting and remained with me during the entire stopover. In Beirut, the ambassador expressed concern because I was eight hours late. In Bangkok I learned that Secretary of State Herter had sent a cable to every embassy notifying them of the Wings of Peace flight. He instructed them to remain with me during the layover. General Quesada of the FAA had done the same thing. He had sent a wire to every FAA post notifying them to meet me and remain with me from landing to departure. (I'm not sure what the good General meant by his instructions.)

AS the Aloha O Hawaii taxied out, the tower said that I would have to land in Damascus because no clearance had been obtained. Knowing that AOPA's Cathy Howser had cleared the way, I checked the files to find that the clearance had been sent for a Super-V of another number. I called the tower who verbally shrugged it off.

Being the father of five children is not without its ingenuity and I was confident that I would be able to wangle a nonstop to Karachi.

Beirut Control instructed a climb out to the south 50 miles and then back, a costly clearance fuel-wise.

After a half an hour of machinations I crossed the mountains and called Damascus Control without trepidation. They said a landing was required. Cleverly, I appraised them of their mistake. They said I would have to land. I knew that the clear air turbulence at the lower levels would be dangerous, so I informed them I would pay the fine at Karachi. They gave me a curt "land."

Not long before, the Jordanian king had tried what I proposed and almost lost his life when chased by UAR fighters. This being the alternate I turned toward the airport. As I let down, in my mind's eye the wings began to flap almost like gulls. The updrafts from the mountain sheer were vicious. I pleaded for permission to go on, if only to save my neck. The same terse command: "Land."

After a bobbing approach and a stone-skipping landing, I taxied in. I paid a $2.37 fine and was cleared to leave.

Without betraying blue-black anger to the smirking inspector, I climbed aboard and left.

It was late at night when I checked Bahrein. Over Sharjah in the Trucial Oman State lay a salt-silt fog to 9,500 feet.

Near Karachi, the terminal forecast gave Karachi as 100 feet with a quarter-mile of visibility. It was expected to open in 45 minutes.

Though I pulled back the power, when I arrived at Karachi the same 45 minutes to

airport opening was still the message. I decided to go to the alternate in the east, then on my course to Calcutta.

When I fueled, I requested clearance to Calcutta. Control informed me I would have to return to Karachi, 100 miles west, clear in and out of Pakistan. Arguments were not sufficient to change the impassive Indian controller, so I followed Air France back to Karachi. After landing I had to go through Agriculture, Public Health, Currency Control, Immigration and Naturalization as if I were going to spend my life in Pakistan.

After lunch, to clear out through the same channels was to the officials as if they had never seen me before. They scrutinized the papers they had just filled out like a classified report on the cobalt bomb.

Four hours from landing, I departed the mustard-colored airport for Calcutta. Crossing the burnt-green landscape, I worked toward Calcutta, eating away the time-distance before the reported monsoon.

South of New Delhi, Control called on VHF. They stated all flights eastbound over India had to land in New Delhi and all flights westbound had to land in Calcutta. Therefore, I would have to deviate north and land in New Delhi.

I replied that I didn't hear and asked them to repeat. New Delhi Control clipped it off again. I said I couldn't read him and continued.

Four hundred and fifty miles from Calcutta I went into the monsoon. The smooth, clear world fell into bits, and violence was unleashed. Tired, void of all sensation, I became part of the mechanical aircraft. Weary airmen must become Buddhists on the gauges. No matter what the seat of the pants says, the pilot must separate himself from the feeling world and act in accordance to the dictates of the instruments. For the next few hours my eyes scanned needle-ball-airspeed in monotonous orbits.

When in range of Calcutta I called Dum Dum Approach. They reported scattered showers.

After landing, the airways controllers came out to the aircraft to look at the radio equipment and installation. The best ever heard, they said.

NEXT came the gauntlet of government agencies conducted as if I were a smuggler and interfused with red tape.

The flight to Bangkok was uneventful, yet I found it increasingly difficult to handle the aircraft. It was as if someone were tightening the hand screw. I broke the check list down to smaller, mincing bites. Before, I had been able to slash through the check with clarity and surety. Now, in the fog of weariness, I could only find a questionable affirmation by calling an item aloud, looking at it, defining it orally, and then touching the dial.

As I crossed over the mountains, below me wound the River Kwai. I looked for the bridge, but it wasn't there.

Rising in the bright daylight of the morning was the visual chaste white beacon—the chalky spire of Phra Chedi Klang Nam, the chapel landmark of Bangkok.

The level-off over the runway was not as high as before. I plopped in as usual and taxied into the ramp where I was met by Colonel Chalermchai Charuvastr, Thailand's director of tourism.

After presenting the Colonel with a fresh vanda orchid lei from the little man in white, he hung a Thai jasmine garland around my neck.

After a yeoman's breakfast I was off for Manila.

As forecast, near the coast of the South China Sea I ran into a line of thunderheads. After hip-wiggling and roller-coastering, I was able to negotiate the storm area though it cost 100 miles.

At 10 o'clock I landed at Manila airport. Met by hundreds of enthusiastic Filipinos, the director of Civil Aviation, Colonel Caldozo, led three cheers when I opened the cabin door.

At every airport I had been able to leave instructions about "don't touch the aircraft" and "just fill 'er up." No matter where I landed, mechanics wanted to replace the plugs, take off the cowling, and work over the engine. My philosophy was, don't touch it as long as it keeps running within tolerances. But the crowd was too dense. By the time I escaped back to the Super-V, the cowling was off and Caltex' John Archer was draining the oil.

The layover at Manila took three hours. Every place I went, a following small, wizened Filipino would suggest that I get some sleep. Had just the place, he said.

The flight to Tokyo was along the perimeter of a developing typhoon. An hour out

(Continued on page 112)

Jules Manger, Jr., Chairman of the Board, Manger Hotels, is seen with his wife and two of their seven children, all ardent flying enthusiasts.

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(Continued from page 111)

I ran into the heavy storm and for four and a half hours I fought—pumping, kicking, praying, swearing, sweating, with fear on both shoulders. St. Elmo's fire formed on the windshield, those frightening blue sparks and flames which race crazily across the glass. Harmless, according to the books, but this was lost in thudding of blood in ears, pressure in darkened eyes, and pins and needles jabbing into the legs.

An hour after daylight the seraphic gyrations came to a halt as the Super-V burst into the clear.

During that four and a half hours all I could do was to average the heading of 054. When I emerged, I had a cup of coffee before leaning over to tune in Okinawa on the ADF.

A sudden prodding feeling that I was being watched came over me. My head made a slow arc to the left as I came up. Flying wing was an Air Force F-104!

I shook my head to clear it of green slime. It was still there! I waved weakly and called Treefrog at Okinawa to tell them I saw the interceptor. They acknowledged and notified me that I was 600 miles west of track. Impossible, I replied, maybe 60 miles but no more. They had me turn north for two minutes and then west. They confirmed that I was 40 miles west of Okinawa. They gave me a heading to intersect Green-8 and I headed toward Kagoshima on the southern tip of Japan.

Out of Oshima I plunged into the upper lobe of the developing typhoon. Again I became a disjointed, separated airman believing what I saw on the instruments, disbelieving what I felt. I squabbled for power and then rejected it. The updrafts were so great at one time, with the throttles off, the currents lifted the Super-V from 2,500 feet to 8,500 feet in what seemed like a short minute. (Because 500 Thunderstorm Project penetrations of anvil thunderstorms had proven that attitude is more important than altitude, I held the nose at the same point on the artificial horizon.) A downdraft escalatored me down to 4,500 feet where side thrusts and jabs took over.

By the time I sighted Tokyo I was punchy. Oxygen gave me a needed lift. I took assiduous care with the checklist.

Upon landing, some 30 newsmen surrounded the aircraft. Just behind the white lei bearer came Pan Am's public relations man, Davy Jones. What was this about your falling asleep, he wanted to know. He said it had been reported that the F-104 pulled up alongside to find me asleep. The F-104 drew up in front of me and cut in an afterburner to awaken me. I had then said that I had "conked" out and was lost. The pilot further reported I was headed for Korea and had said I was lost. Radar reported me 400 miles west of track. Without the Air Force's intercept, I would have plunged into the sea, was the final reading.

In the press room a laid-out map showed that had I been 400 miles west of track I would have been sitting in Chou En Lai's lap in Peking. And what the heck was an F-104 doing over China?

The phone rang. I asked Mr. Bogarde of the State Department and Mr. Stephens of the FAA to listen in. Capt. Taylor from Fuccu Air Force Base said he had been instructed by Headquarters Command, Okinawa, to say that they did not know how the spurious report got out. It was not true, in fact, and they were sorry. They also asked that I go easy on the press and not mention it to the State Department.

The forecast for the route to Wake Island was 12:44. Instead of following the Pan American sashaying wind-seeking track, I overheaded Marcus Island. The ADF picked up Wake Island four hours out. When it settled down on a bird dog "point" I was relieved. I was going to find the small-as-a-football-field plot of real estate, after all.

I landed at Wake late at night. The flight plan to Honolulu was 13:47. The track would take me through a low pressure area. It meant three or four more hours of instrument flying but I was on the downside of the trip, unconcerned, though in a semi-catatonic state.

Three hours out of Barbers Point a Coast Guard C-130 called me on 121.5. I gave him my position. He made an intercept and feathered both outboard engines to fly wing all the way to Oahu.

Early in the afternoon Aloha O Hawaii touched down in Honolulu after eight and a half days of flying. I checked the mags as I taxied in. It was the same 50 rpm mag drop.

When Murrayair's Bob King asked me what I wanted done to the aircraft, I said: "Wash it."

END

Air Traffic Control

(Continued from page 37)

angle, heading and position. The airplane shown in the center moves over the grid and indicates to scale any divergence of the aircraft from its programed or predicted flight plan position along its route. The speed indicator at left shows any deviations from predicted or programed ground speed. In this example, the aircraft is traveling above predicted speed.

During a flight program calling for a fixed altitude, the altitude indicator at right will show any divergence above or below that altitude. When a sustained climb or descent is called for, the indicator will remain at zero as long as that rate is being maintained. In this example, the aircraft is traveling above predicted altitude.

In Figure 2, assume the original winds have changed. This is reflected by a ground speed of less than the originally estimated 450 knots and a larger required drift angle then expected. The airplane indicator has moved off course and fallen behind schedule. In order to get back on flight plan, the pilot must increase power and change course momentarily. When changes in wind or weather conditions are too great, he must refile a flight plan and select a new ground speed within the aircraft's capabilities. When he is making an appreciably higher ground speed, he also refiles. The new data is then inserted into the computer. In either case, any difference between planned performance and actual performance becomes evident immediately to the pilot, not some time later, after divergences have already occurred.

If an aircraft must deviate from its original course and the deviation is not of seri-

ous extent, the pilot could return to his original course and make up the lost time through use of reserve power. For greater deviations, however, it would probably be necessary for him to refile the flight plan with the traffic control system, get a clearance, and reset to a new fix that will clear the storm area.

Figure 3 shows an aircraft on IFR clearance off airways. If this procedure were approved, you can see the flight plan calls for crossing five airways. Here are five distinct opportunities for mid-air collisions if precision navigation, with strict altitude control, is not employed. But the pilot using precise reading navigation equipment can predict time of interception of each airway he crosses with complete accuracy and, when coordinated with the controller, there is no danger of collision.

Figure 4 illustrates how it is possible to get more efficient use of airspace as a result of increased accuracy of navigation. Under the present system, as shown on the left in the diagram, a 600-knot aircraft requires 100 miles of reserved airspace in order to provide minimum safety. At the right of the sketch, the precisely navigated aircraft can adhere so closely to flight plans that air space envelopes now required for each airplane can be enormously reduced. Then, traffic along major airways can be increased and large areas for non-scheduled general aviation aircraft will be made available en route as well as at the terminal areas.

Figure 5 is a comparison of radar screens. The screen on the left shows congested traffic conditions in a terminal area. The screen on the right is a representation of the kind of traffic patterns we should be working toward, with completely organized programed flight. Note how elimination of holding stacks has reduced saturation, and how increased airspace has been made available for unequipped or general aviation aircraft.

If ground control centers were working with more accurate information, landing rates at major terminals could be increased far beyond those presently feasible. Arrivals would then be spaced to insure minimum time intervals between touchdowns of various aircraft with different landing requirements.

If all aircraft were equipped and operating within the system, the effect would be like a conveyor belt extending outward from touchdown point, with partitions of equal size holding each aircraft (Figure 6). Feeding this conveyor belt would be additional belts, the airways leading to the terminal area. With the belts properly synchronized, aircraft would reach the touchdown point at regular intervals and at whatever rate selected by the "belt" operator.

To translate this back into aviation terms, aircraft would be assigned runway touchdown times based on their flight plan schedules, while still some distance away. If each aircraft were equipped as proposed, it would be possible for each to arrive at safely spaced intervals. Stacking and holding procedures necessary today due to the impossibility of controlling arrival schedules would be nearly eliminated.

This system of precise control over time and position is not only desirable; it is an absolute necessity if we seek safe air travel in the future. END

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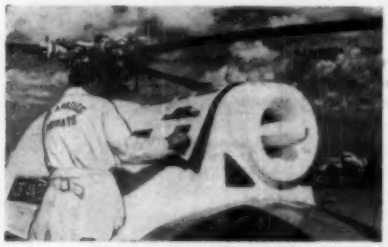

Photos, courtesy Los Angeles Airways, showing new Sikorsky S-62.

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Motorola M-4

(Continued from page 47)

made using Gaviota omni, a few miles beyond Santa Barbara. A descent from 10,000 to 1,500 feet was made along the path of the localizer on the outbound heading, but with the AFCS in heading mode rather than localizer. Confirmation of the track was obtained to a reasonable degree by passage over marker beacons.

Operation in heading mode of AFCS is effected through the "Hdg" button on the controller with the autopilot engaged. A feature of the M-4 is inclusion of a small heading select dial on the controller unit itself, which is graduated in five-degree increments.

The AFCS automatically will turn to the heading selected on the controller dial, but compass information is obtained from the panel gyrocompass. Among the advantages of this approach are a reduction in the number of selection knobs on the panel instruments which give compass or directional information. In this way, the pilot has a greater degree of freedom in choosing intermediate headings to be assumed temporarily, yet is not confused by several control pointers on the various heading instruments, including the gyrocompass.

While in heading mode, turns can be made by changing the setting of the heading select dial, which does not disconnect the mode. Making a turn with the manual controller automatically disconnects the heading or capture or track modes, returns the airplane to three-axis autopilot only. If altitude hold is engaged, making a pitch attitude change with the manual controller knob automatically disengages the hold.

The descent was made with the aircraft in clean configuration and power reduced. The desired 1,000-fpm descent rate was obtained by beeping the pitch control knob until the desired rate was obtained through attitude. No specific airspeed was sought or held.

After flying part way down at 1,000 fpm, power was again reduced a bit and a 2,000-fpm descent rate set up, again established through attitude.

INBOUND track of the ILS was again flown in heading mode. After the procedure turn was completed in manual autopilot and the inbound heading assumed at the desired descent rate of 1,000 fpm, the altitude hold button was activated at 20 feet above the desired inbound altitude. The aircraft oscillated one cycle about the desired altitude, then held.

A check of the automatic pitch trim and altitude hold simultaneously was made by lowering the aircraft gear and 30 degrees of flaps, with 12 inches hg mp, which yielded a 95 mph IAS, a slow speed for the 310. The aircraft held altitude well, with only a slight porpoising noticed as the flaps were dropped in the rapid configuration change.

Flap setting was changed to 15 degrees and power advanced to 18 inches mp, bringing the airspeed up to 115 mph. Altitude held constant, and there was no porpoising as the flap setting changed.

At low airspeeds in clean and dirty configuration, the aircraft rocked gently in the roll axis, a function of soft gain in yaw rate gyro circuitry and roll circuitry. This was corrected immediately after the flight to maintain a tighter roll control, although the movement allowed was not excessive, unpleasant or unacceptable.

There were, at the time of the evaluation, several functions in the system for which final gain settings in the computer amplifier had not yet been finalized. As more pilots fly the system, both airframe company pilots, corporate customer pilots and additional outside objective observers, final settings for the system will be evolved, keeping in mind that it is impossible to please all pilots at the same time.

RETAINING the altitude hold mode, the airplane was put into clean configuration at 100 mph where the rock mentioned earlier still was present.

During the approach to Santa Barbara, it was apparent that a strong crosswind was blowing. For such a situation in localizer or VOR flight, the M-4 includes crosswind correction automatically, but not in the heading mode.

Following a landing at Santa Barbara, where the approach was made with the autopilot until about one-half mile from touch-down, the second flight was started with a high rate climbout from takeoff to 16,000 feet for investigation of system capabilities at altitude.

Following flight on the Oxnard Omni, the AFCS was returned to autopilot only mode and manual maneuvers accomplished in this mode to sample the system's handling of the aircraft at altitude.

Steep turns, both left and right, with full hardover signals used to change directions, showed the AFCS controlling the airplane smoothly, with highly acceptable response rates. Steep climbs and climbing turns to the point of stall were made, as well as abrupt dives, descending turns and pullups. In all cases, the system responded well, showing an excellent match between system gains and airframe dynamics, over a wide range of speeds, altitudes and configurations.

The altitude hold mode also was sampled at 16,000 feet, with the aircraft in a climb of more than 1,000 fpm when hold was actuated. The plane nosed over smoothly, did not porpoise, although airspeed was slightly more than 100 mph when the hold was actuated.

After the altitude sampling of the AFCS manual autopilot flight, a capture was initiated on a radial of Los Angeles omni at an angle-off of more than 90 degrees, still at 16,000 feet altitude. Again, the system took its prescribed cut at the selected radial, and track mode was initiated at the proper time and effected immediately.

During the same time, the course director function of the M-4 was sampled, including the CD monitor function. In the CD mode, the radio omni signal, or heading signal from the gyrocompass, which normally would go into the lateral (roll) channel of the autopilot computer amplifier, instead is fed to the vertical needle of the VOR/ILS indicator to provide steering information. Since it is computed data, flying to keep the needle centered takes the aircraft along the prescribed course to intercept the desired radial giving, in effect, zero-reader type information. The airplane

has to be flown manually in the CD mode, since data goes to the needle instead of the autopilot.

During an approach to a radial, localizer or selected heading, pushing the spring-loaded CD monitor switch makes the vertical needle temporarily move to show actual displacement from the desired course or heading, when the switch is released, the needle returns to zero-reader type display.

Coure director function is initiated with the CD control switch on the instrument panel, which accomplishes the transfer of information from the autopilot roll channel to the VOR/ILS indicator vertical needle.

A concentric knob in the CD control switch operates the *reverse* CD functions for localizer and radial back course flying, which gives normal left-right readings on the VOR/ILS indicator. The reversing actually consists of changing polarity of the inputs to the needle so that it indicates displacement the same way it would flying a front course.

The course director function operates with omni flight in capture and track modes, and in the heading mode, where again, flying to center the needle automatically assumes the proper heading for intercept of the selected heading.

Following accomplishment of capture and track at altitude, sampling of CD function in omni and heading modes, the aircraft was brought down for a coupled ILS approach to Los Angeles.

Vectored to a point northeast of the LAX outer marker by Los Angeles Approach Control, the AFCS was engaged and an automatic capture from about 45 degrees off the localizer course was effected with the system performing well at low altitude and medium speed. Altitude hold was not used.

Inbound to intercept the localizer, the aircraft was held 700 feet above the published altitude for intercepting the glide slope at the outer marker. When the aircraft was established in the track mode on localizer at the outer marker, with gear down and 130 mph airspeed, the GS button was pushed with the aircraft still 700 feet above the prescribed altitude, to sample the system's capabilities in capturing the glide slope from a somewhat extreme distance off.

When the glide slope capture was initiated, the aircraft nosed over rapidly but did not dive abruptly, held a constant attitude until it intercepted the glide slope and settled onto the slope after one cycle of oscillation (a slight initial overshoot, over-recovery, then onto the slope).

Overall smoothness of the AFCS response rate and control of the aircraft in the unorthodox glide slope capture showed an excellent standard of performance.

Coupled approach was continued smoothly to a point past the middle marker after which a small pitch oscillation occurred. However, it should be noted that under normal IFR conditions, at this point either the aircraft would have broken out at published minimums or, being below minimums, would have initiated a go-around.

The pitch oscillation which developed was not an inherent fault of the AFCS, but just another area where a finalized gain setting had not yet been established. The fault was eliminated immediately after the FLYING evaluation.

Heart of the M-4 AFCS is its computer amplifier, the "black box brain."

The computer amplifier is typical of the design philosophy behind the M-4 mentioned earlier—to obtain reliability through combining functions and packaging—and is illustrative of the techniques used to get the desired system characteristics.

All electronics in the M-4 system, including the computer amplifier, are designed around and use only solid state components which are significantly derated for each application, to insure long service life—600 hours between overhauls is the design goal.

There are nine special circuits in the computer amplifier. All are solid state etched circuits, plug-in modules, which control the autopilot and flight path computer functions of the system.

An important part of the unit is the calibration board, in effect the gain controller of the other circuits. These calibration boards are set up according to the individual model of aircraft the system is to be used in, such as a Cessna 310D, a Commander 560F, a Bonanza D-50, etc. They also are integral parts of the computer amplifier, interior mounted, and cannot be changed by informal screwdriver engineering.

All internal wiring in the computer amplifier uses taper pin connection, eliminating

(Continued on page 116)

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(Continued from page 115)

cold solder. This actually is a military development which Motorola incorporated in the M-4, feeling that the increased reliability and lower maintenance cost more than offset the higher initial cost of the pins. The connector sections of the plug-in modules are all rhodium-plated, another military electronics approach deemed worth the effort in increased reliability. Such additional touches throughout the M-4 system as hermetically sealed relays are used, again with the goal of reliability.

The reasoning behind the M-4 design and packaging philosophy has been that the system approach is the most businesslike, and the stricter the adherence to sound business principles throughout the system, the greater the success for the M-4 and its users. Business aircraft today mostly cost $30,000 to $100,000, and when out of commission for autopilot problems, are costly in time as well. Therefore, any significant increase in system reliability, hence airplane in-commission time, is worth money, and makes the touches incorporated into the M-4 system worth their cost.

To top it off, the M-4 is being TSO'd to C9c standard.

Further extending the solid state design of the M-4 is the optional dc-ac static inverter which, when used, mounts externally on the front of the computer amplifier.

Other unseen elements in the M-4 include the altitude control unit, an aneroid bellows with electrical pickoff to sense changes in height and send corrective signals to the pitch control channel of the computer amplifier.

Servo actuators, working through two magnetic powder clutches and a torque limiting clutch each furnish "muscles" for the M-4 system to move appropriate control surfaces. A trim servo also is used to accomplish the automatic pitch trim and synchronization. These units provide displacement and rate feedback signals to the computer amplifier to prevent overcontrolling and provide surface followup information to the system.

The cockpit instrument elements in the M-4 also serve as reference sensors for the system. The gyro in the attitude indicator has pickoffs which provide deviation information for the pitch and roll axis, while the directional gyro furnishes azimuth reference through a synchro system. The turn-bank gyro furnishes yaw rate information to the yaw channel of the autopilot which, as mentioned earlier, can be used during manual flight to provide yaw damping.

Data from the directional gyro is fed into the roll channel of the autopilot when in the Capture or Track or Heading mode, from which the system knows which way to turn the airplane and how much, in order to achieve the desired flight condition, be it on omni, localizer or heading.

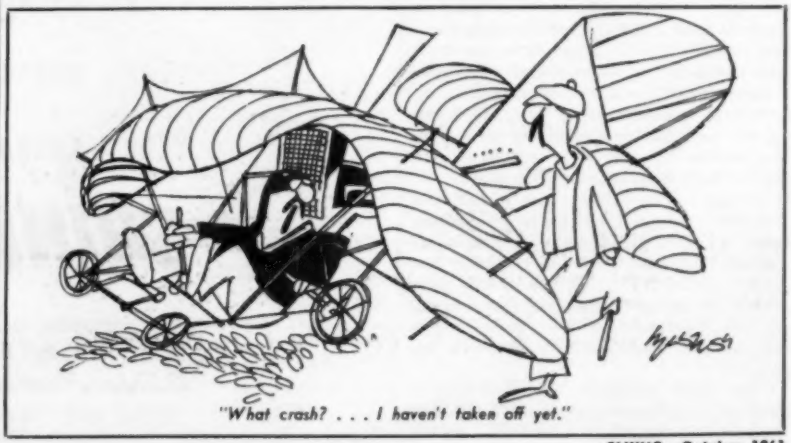
Weight of the gyro instruments which are part of the M-4 are not included in overall system weight since they merely replace gyros already in the airplane. The instruments are remanufactured to Motorola's specifications from surplus five-inch gyros, of which there is a plentiful supply.

Yaw damper on the M-4 is provided through a switching arrangement whereby only the yaw channel of the autopilot is engaged when this operational mode is desired. Yaw channel functions to keep the rudder streamlined with the vertical stabilizer, with sensing from the rate of the turn-bank gyro's displacement. Streamlining is employed since turns are made through the roll channel of the autopilot. There is a provision as well whereby constant rate turns such as a pilot makes in manual flight will bypass the yaw damper, but will not disconnect the function.

Although completely firm pricing is almost impossible in blanket terms for a system like the M-4 due to variations in aircraft installation, etc., the unit will cost in the $8,000 to $10,000 bracket. Motorola indicates that autopilots-with-extra-components run in this same price range when all assembled to the same general number of functions and capabilities, although extra installation costs usually run the total cost higher.

Installed weight of the M-4 is 50 pounds, including wiring, while the total number of components also is less than those of a system built up around an autopilot-with-extras.

According to Motorola the M-4 has been STC'd for the Aero Commanders, twin-engine Cessna series and Beeches. The prototype system was developed on Motorola's Beech Bonanza engineering test airplane. Piper twins and other heavier single-engine aircraft soon will follow. A prototype of the system also has been installed on a Morane-Saulnier MS-760 Paris four-place jet. Deliveries of the M-4 will start in October. END



"What crash? . . . I haven't taken off yet."

FAA Center

(Continued from page 35)

Another activity centered at Oklahoma City is automated checking of air navigational aids. It's called Project SAFI—Semi-Automatic Flight Inspection. Currently, it's being performed with an electronically packed Convair.

The second phase of SAFI is a ground-based computer—an IBM 704—used to produce flight tapes which control the Convair in its flight, but not on takeoffs or landings. After the day's grid has been selected, pertinent data is gathered and entered into the computer, which programs it, producing a magnetic tape which is then used to actually fly the Convair over the correct air navigational aid route. The tape also tunes the radio sets, calibrates them, and has information stored on it permitting an evaluation of the signal received from the ground facility. Results of hundreds of questions put to the air navaid stations are recorded on another magnetic tape in the plane. This second tape, after the flight, is sent to the ground computer in Oklahoma City, where an analysis is made, providing a quick, certain check of navaids facilities. This means that where it once took weeks of manual analysis to effectively compute a facility's performance, such work can now be done in hours, with greatly increased accuracy.

The newest, and what many consider to be potentially the most important of the Aeronautical Center's facilities is the Civil Aeromedical Research Institute. CARI, as it is called, operates under the FAA's Bureau of Aviation Medicine, in Washington, D. C.

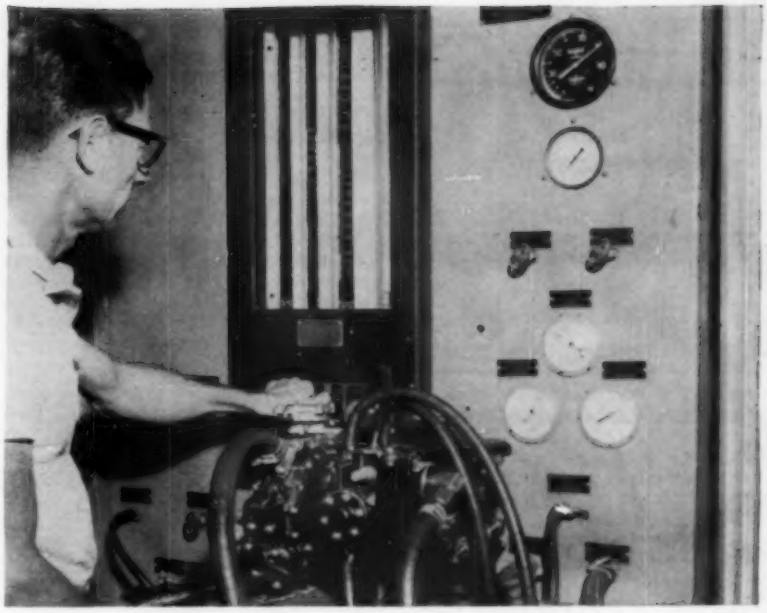
Among other projects, CARI researchers are carrying on activities in the fields of stress and fatigue factors in controllers and tower operators, pilots and other airmen. One study is concentrated around the use of electronic medicine. In this area, the controller, or control tower operator, is wired for sound. He wears a transistorized electronic belt. Some miles away a telemetering van picks up the electronic signals which spell out the blood pressure, respiration, brain waves and the like, all factors in determining the stress and strain under which the man works.

In this way, many questions are answered. Should a controller or control tower operator work a straight eight-hour shift without relief? Is there a point of physical or mental fatigue at which the man loses efficiency? Where is the point of no return?

In other areas of medical research at the Oklahoma City Aeronautical Center, studies are underway for survival after crashes, how to cut down on the high rate of accidents in crop dusting, and the best seating methods for airline passengers. The aging factor, in all fields of aeronautical endeavor, is being carefully studied, particularly in light of the FAA regulation which now sets a mandatory retirement age of 60 for airline pilots. Already determined is that a physiological, not a chronological age, should be a major factor in examining pilots for either general or commercial aviation.

The CARI scientists also subject all

(Continued on page 118)



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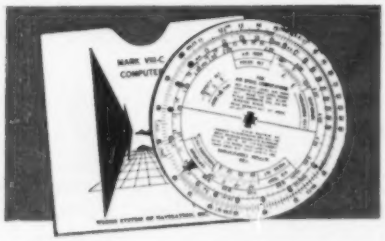

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(Continued from page 117)

candidates entering the controller classes to take a stiff battery of examinations. Typical is the visualization test.

On a printed page are eight boxes. On the left side of each box are 10 numbers. Connected to each number is a line. It winds, curves and crosses all the other lines in a complex maze before ending in an unnumbered box on the right side of the diagram. The idea is to follow each line visually to its proper place on the right, putting in the number there from which the line starts on the left. Three minutes are allowed to complete the 80 lines. This is a good example.

ONE test that gives the instructors an idea of a man's inherent ability to find something meaningful, without knowing what he's looking for. Lines of jumbled letters fill a printed page. Imbedded in each of these lines are combinations of letters making up specific words, like this:

HFGBNVYWARPJKLGFBKRTILTQW
SZXFGVBDOESGYPLKMBGTUKLZTNI

The words imbedded here are "WAR," "WARP," "TILT," "DOE," and "DOES." Two and a half minutes are allowed for this test. There are 22 lines to decipher.

Future tests will be run by CARI on the effect of stress and fatigue on controllers as they actually work. These studies will include analyses of the side effects of variously commonly used drugs, such as aspirins, antihistamines and tranquilizers, on mental acuity, the effect of diet, stress and fatigue on energy output. Also underway is a study to develop more accurate means to evaluate behavior patterns in successful and unsuccessful on-the-job performance, and the effect of physical and environmental working conditions.

"Ours is one of the most challenging medical research jobs in the world today," says Dr. Milliard D. Estes, Director of CARI.

Another part of the Aeronautical Center complex is the FAA's Examination and Records Division. In a downtown office building—soon to be moved to new quarters at the Center itself at Will Rogers Field—are row after row of filing cabinets, filled with pilots' certificates and aircraft registrations. This department moved to Oklahoma City from Washington in 1960. It handles 1,750,000 airmen's certificates, of which over 750,000 are active. Also in their files are records covering 340,000 registered aircraft.

Keeping tabs on the nation's pilots and planes is a tremendous task in itself, but it is only one side of this department's work. The other is examinations. This job—and all FAA examiners are pilots or experts in other fields—revolves around the various FAA examinations given to pilots and other airmen. These range from private pilot through mechanic to controller and even to free balloon pilot.

But the real heart of the Aeronautical Center is in its classrooms. In 1961, some 12,081 students will complete various courses there. Next year, the total is expected to be 15,000. In addition to these students on the Oklahoma City "campus," the Center also administers a rather extensive correspondence course program. Approximately 9,000 FAA employees are now enrolled in it, the majority, revealingly, in the electronic maintenance subject matter area.

For resident students, there are three major areas of training.

Air traffic controller is a prime course. It provides the key to the juggling of the increasing speeds and traffic jams in the clouds today—particularly in airport areas.

As air traffic grows, more and more controllers are needed. To provide them, the Aeronautical Center graduates 1,700 new ones each year. Since opening in 1951, this controller's school has turned out more than 10,000 graduates. A new class is started every two weeks; four separate groups are in training at all times. The basic course is eight weeks. After that, the graduates are sent to actual control towers around the country for on-the-job training.

Graduates of this school now make up the bulk of the U. S.'s 12,000 air traffic controllers. Twenty per cent of all candidates starting each class fail to make the grade. Another five per cent are washed out during the next year, after they have graduated from the demanding classroom work and taken up on-the-job training in control towers and centers around the nation.

Stress is behind most of these failures, in one form or another. Many of them are men who just can't handle several tasks simultaneously, such as broadcasting a message to a departing airplane while copying information for another flight.

During the eight-week controller course, classes are held eight hours a day, five days a week. Also, there is 125 hours of extra homework, nights and weekends. During the grueling study period, students—who live in Oklahoma City boarding houses and motels during their schooling—average less than six hours' sleep a night, have no time at all for recreation. Basically, their training covers seven areas: air traffic rules, aviation weather, navigation aids, communication procedures, airport approach and control procedures and radar air traffic control procedures. Each of these, though, unfolds into many subjects.

HOURS are spent sharpening abilities for the simultaneous input and output of information of different and unrelated types. In handling simulated traffic in the classroom "airports," much time is spent on timing.

They have to learn the operating characteristics of every type civilian and military plane flying; know, for instance, that a DC-3 cruises at 140 mph, that the slowest final approach speed for a Boeing 707 jet is 148 mph, that maximum gear down speed for a Beech Bonanza is 125 mph.

Classes are equally divided between lectures and books and the realistic practice of simulated air traffic problems, which develop in complexity as the course progresses. Every day there are written and oral examinations and reviews, more than 50 total during the eight weeks at the Aeronautical Center.

Another Aeronautical Center course—it will graduate 1,169 students in 1961—is the Flight Standards School. It provides operational qualification and refresher training for all types of FAA pilots, including air carrier and general operations inspectors, engineering flight test inspectors and facilities flight check pilots. The school

also provides technical training for air carrier and general maintenance inspectors, electronic-electrical systems inspectors, and engineering personnel in a wide range of studies involving powerplants, airframes and aircraft systems.

The largest school program at the Aeronautical Center, however, is in the electronic maintenance of air navigation facilities. Some 8,348 students will graduate from its courses at the Center this year. In this section, training is conducted for the FAA's facilities maintenance engineers and technicians, with subjects being grouped in five general areas: communications equipment, ILS and VOR, distance aids, radar, and airborne electronics.

It's a general FAA policy to provide Oklahoma City with one of the first production models of new equipment, in cases where training is to be conducted on a centralized basis, as it is at the Aeronautical Center. This year, for instance, the Center will receive and initiate training on a newly purchased Lockheed Electra and Boeing 720. Training in a new Convair 880 will be inaugurated this year also. These new aircraft are used primarily for basic qualification and refresher training for air carrier inspectors.

The Center also provides courses in management for supervisors.

As a new project this year, the Center's air control school will start air traffic control training for a limited number of U. S. Air Force personnel. If the experiment is successful, they will eventually assume responsibility for training all military air traffic controllers.

The 15-week prototype course for the military trainees include 10 weeks of academic and laboratory training in basic air traffic at the Oklahoma City Center, followed by five weeks of radar training at Keesler Air Force Base, at Biloxi, Mississippi.

The Aeronautical Center—located in Oklahoma City since 1947—really started its present growth with the dedication of the new Headquarters building in the summer of 1958. Today, the Center has more than $30 million worth of modern buildings, more than 3,000 employees, and a $26 million annual payroll. Sometime next year, a new $8 million three-story medical research building will be erected at the Center. Also planned are several new school buildings.

It is these facilities that are the hub of the FAA's far-spread operations, a task that is highlighted in cold statistics. Right now, in the United States alone, there are more than 70,000 civilian aircraft, plus more than 2,000 commercial planes. Over the next few years, it's a good possibility that the FAA will take over the responsibility of controlling all U. S. military aircraft as well.

The FAA has to see that this vast aerial armada—in the air and on the ground—is operated well and safely. The men and many of the methods to do this job have to be good.

Because they are good, because the FAA Center does its job so well, America's airspace is "growing." The airspace itself, of course, cannot be expanded. But with training and planning, it is being utilized more efficiently, providing more flying room. END

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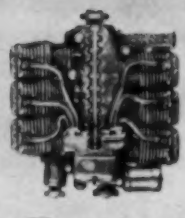

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BONANZA EXPERIMENT

TAKING THE Civil Aeronautics Board at its literal word when the agency told the U. S. airline industry to try some "experimental new ideas" to generate new business as the answer to the rising cost-fixed fare dilemma, Bonanza Air Lines did just that with a promotional scheme it calls "BonanzaLand."

A local service carrier operating in California, Nevada, Utah and Arizona, Bonanza looked at all the famed resorts and vacation spots on its routes and proposed to allow travelers an unlimited amount of travel over Bonanza's entire system for fixed fees under certain conditions.

Bonanza's scheme is simply that travelers originating their trip beyond certain distances away—Canada on the North, Mississippi River on the East, 39th Parallel in Mexico South—who are making the trip by common carrier, can travel anywhere, anytime, as often as they want over Bonanza's routes for a two-week period for $90; for a 30-day period for $160.

The common carrier provision is a move to get new business from persons who might make the first part of a long trip on bus or train and, when arriving at any city on Bonanza's routes, can start traveling by air at reasonably low cost. The common carrier provision also blocks such travelers as family automobile vacationists from taking almost-free extended air tours.

Meanwhile, planning for the future, the airline has petitioned for new routes and additions to existing ones, and the outcome of the Pacific Southwest Service Case will have considerable influence on what new equipment may be acquired by the airline.

Officially Bonanza now is looking at the "baby Caravelle," at a twin jet Fokker has in the design mill, and British Aircraft Corp.'s BAC 111. Reports have it that the BAC 111 has airplane-mile costs the same as the Canadair 540 (turboprop Convair), Bonanza officials say, and if true, it makes this aircraft "most interesting," they say.

RICHARD L. SWEENEY

Heli-Trainer

(Continued from page 42)

landing platform which simultaneously block the platform itself and prevent it from tilting in the lateral and longitudinal axes, or from yawing left or right.

As pitch and throttle are increased in coordination the Heli-Trainer "takes off," that is, its skids rise from the platform. It remains, however, elastically and physically tied to the platform by the steel tube and spring support assembly. The springs support 80 per cent of the empty helicopter's weight (716 pounds) during flight. The other 20 per cent and the pilot's weight is supported by the engine. This support assembly permits the BO-102 to be hovered at heights up to two feet between skids and platform.

Once power and altitude control are mastered by the student alone (the instructor has only a hydraulic brake), the three locking pins are successively removed. Rudders, fore and aft motion of the cyclic, then lateral cyclic are freed for the student's use; first one at a time, and then in combination, so that the student builds up gradually and analytically to a completely free hover. It was an interesting experience for a former helicopter pilot who had not hovered in two years to lead (and follow) this machine through its paces. Free hovering is, if anything, more difficult than in a real helicopter because it is impossible to raise the machine out of ground effect. Added to the effect of the wind, which acts as on an ordinary helicopter, this made for a challenging and instructive half-hour. As soon as one problem was solved, another was added, with Lill finally cutting out the engine. Splitting the needles and holding pitch up, the machine landed positively on its skids.

Bolkow has sold 10 Heli-Trainers, mostly to the armed forces of different European countries. Trainers have been sold in Germany, Spain, France and Sweden. Produced in Munich, the BO-102 sells for $25,000, complete with transport trailer, spare parts for 1,000 hours, and all tools. Should a reported U. S. Army interest materialize, the price would undoubtedly be lowered by the economies of a series production.

The Hiller Aircraft Corp., Palo Alto, Calif., is coordinating with Bolkow on sales of the trainer in North American markets.

The BO-102 does not simulate flight; it flies within limits. This unique combination of realism and safety should make it worthy of consideration by helicopter schools, especially in countries possessing relatively few real helicopters. END

Shinn 2150-A

(Continued from page 68)

Seats are well padded and neatly upholstered, look as if they will wear well, an important aspect of a plane where most pilots will accidentally or purposefully plant a foot on the seat while entering.

Instrument panel layout is good—engine gauges are on the lower left side, flight group in upper left-center, a place for directional gyro and attitude indicator in top center section of the panel for those desiring IFR capability, and the panel-mounted radio controls on the right hand side of the panel.

SHINN 2150-A

Specifications:

Wing span	30 ft.
Wing area	144 ft.
Length	21.2 ft.
Height	7 ft.
Power loading	12.12 lbs/hp
Wing loading	12.5 lbs/sq. ft.
Gross weight:	
Normal	1,817 lbs.
Utility	1,570 lbs.
Empty weight	1,125 lbs.
Useful load	692 lbs.
Baggage capacity	50 lbs.
Fuel	35 gals.
Engine: Lycoming O-320-A2B, 150 hp @ 2,700 rpm.	

Performance:

Top speed	148 mph
Maximum cruise	135 mph
Stall speed	52 mph
Takeoff over 50 ft. barrier	440 ft.
Landing over 50 ft. barrier	450 ft.
Best rate of climb	78 mph
Rate of climb (sea level)	1,450 fpm
Service ceiling	22,000 ft.
Cruising range	525 mi.

Ignition switch is key operated, and acts as starter when turned to the spring loaded extra position, like modern automobiles.

A fuel boost pump, with the switch located on the right hand side panel, lifts the fuel from the two 17.5 U. S. gallon tanks to the engine.

No instrument panel is provided in the rear cockpit—as complete coverage of the front panel is easily obtained from the rear seat.

Cockpit enclosure is tinted plexiglass all around, with a metal panel on top providing sun shade. The aircraft is certificated for flight with the canopy full open.

The noise level of the airplane is unexpectedly low—all things considered, there is no real problem in conversing between

(Continued on page 122)

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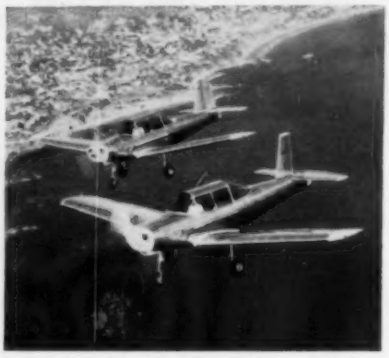
(Continued from page 121)

front and rear seats in cruise flight.

General flight characteristics of the Shinn confirm the impression of neatness—controllability is good as is response rate. The airplane handles crisply on the ground as well, and preflight runup is simple and straightforward.

Evaluation was made on the first production airplane, N2150S, which, along with



Shinns in Formation

the second production craft, has been kept by Shinn for factory use. First delivery airplane was number three, which was delivered in midsummer to a dealer in Phoenix, Ariz.

Temperature at Van Nuys, Calif. was above standard on the day of the evaluation; however, the airplane was somewhat under maximum allowable gross weight thus tending to cancel out the heat effects.

Probably the most noticeable feature of the Shinn after it breaks ground in takeoff is the high rate of climb for its class. During the evaluation, initial climb rate exceeded the specified 1,450 fpm after initial liftoff by a margin sufficient to indicate that specification can be met or exceeded at normal gross weight.

ALLOWING the speed to build up above best climb of 78 mph IAS reduces the climb rate a bit, but allows a better overall combination of horizontal distance covered and altitude gained. Climbing turns are good, and the aircraft's excellent full circle visibility is invaluable in a high traffic density area such as metropolitan Los Angeles.

Cruise speed at lower altitude showed the Shinn able to hold a 125 mph TAS at 3,000 feet, with a free air temperature of 80F and power at 2,475 rpm at 2,350 rpm the airplane registered 119 mph TAS. Other samplings indicated the airplane has no trouble making its specified maximum cruise speeds at optimum altitude.

The airplane showed a good degree of static stability in flight, with a long-period, slow recovery from induced longitudinal oscillations from cruise speed trim, in dynamic stability samplings.

The airplane gives more than adequate aerodynamic buffet warning of approaching stall, although it incorporates a safe flight stall warning system. In the stall, the break is clean, and lateral control is retained. Holding the stick full back and allowing the airplane to go ahead on its own showed the Shinn will make a partial recovery as airflow over the elevators becomes effective after the break, followed by another pitch and break and a fairly regular oscillatory drop. Adequate lateral control is retained throughout the cycles. The 2150S was dropped some 1,000 feet in this condition.

In slow flight the Shinn retained excellent controllability, although response rate and sharpness deteriorated, at 58 mph IAS with half (12 degrees) and full (22 degrees) flaps extended. The aircraft could still be flown precisely through two-and-one-half needlewidth turns, using 2,350 rpm at 2,000 feet MSL. Generally speaking, the performance is very good in slow flight conditions.

Flight and handling characteristics at the other end of the spectrum—near the redline maximum speed of 170 mph IAS, retain the good qualities of normal speeds. Controls stiffen with the increased dynamic pressure; however, the airplane still makes coordinated turns without undue effort.

MAXIMUM effort takeoffs showed that the craft can break ground at low speeds while retaining adequate flight characteristics, and the same can be said of minimum speed, full flap, steep angle approaches. The airplane can be broken off the ground in the 50 mph IAS speed range, and brought "down the chimney" at speeds in the high 50s or low 60s.

For normal operations the Shinn comes over the fence at about 85 mph IAS, can be flown right onto the ground after rotation for a very neat landing, without having to be completely stalled to make it quit flying. Use of partial or full flaps does not significantly lessen the plane's stability unless unusual turbulence exists on the runway.

The Shinn 2150-A has a solid feel both in the air and on the ground; there is no excessive rattling and banging during a high speed taxi, or during low-speed climb.

Structurally, the Shinn uses a chrome molybdenum steel tube truss in the forward fuselage, monocoque aft section from the cockpit back. All metal control surfaces are used, while wing tips and nose cowling are of glass fibre. VHF antenna is mounted in a wingtip, reducing drag.

Basic price of the Shinn 2150-A is $8,950 f.o.b. Santa Ana, with radio and IFR instruments optional at extra cost. The airplane is offered with nav/com by King, some of the Narco line and some Motorola products.

The trainer version of the Shinn will be available in from six to eight months, the company indicates, will not have flaps and will use a 100-hp Continental engine. Price will be about $1,000 less than the 2150-A for the airplane, which otherwise will be identical to the 2150-A except for engine and flaps.

First Continental engine for a trainer was delivered to Shinn in midsummer. However, the backlog of orders for the standard model will preclude feeding in the trainer version for the time period mentioned earlier.

Shinn also has in the design stage now, a four-place airplane which is intended to sell for less than $12,000. Prototype of this aircraft will not roll off the line for more than a year yet, but the company does acknowledge that design work is well along. END

Cessna 320

(Continued from page 39)

pit. Choice of radios is optional, but careful selection is important, since above-the-weather flight means climbing and descending through instrument conditions. Instrument layout in line with the normal mission of the aircraft is also an important part of any aircraft purchase.

Starting procedure has been simplified in the Skyknight through the use of Scintilla retard-type impulse dual magnetos. These incorporate the magneto switch, starter, and optional oil dilution switch in one unit for each engine. Beside cutting down the number of switches required, there is also a weight saving involved. The scintilla magneto provides a more convenient tachometer pickup source and eliminates tachometer generator installation. When combined with the fuel injection engine, which requires only four pounds of auxiliary pump pressure to the fuel spray nozzle, starting is almost instantaneous.

After turning the magneto switch past the "both" position and a start is obtained, the spring-loaded switch is released and returns to "both."

Taxiing visibility is excellent in the tricycle-gear Skyknight and either the preferred positive control nose gear mechanism or differential power with brake and rudder takes care of ground operations nicely.

Takeoff was from Cessna's 1,900-foot strip into an eight-mph cross-wind from the right on an 85-degree F afternoon. Aboard Skyknight N5701X for the evaluation were Tony Lansbarkis, Cessna's Skyknight Sales Specialist, and Randy Greisinger of Cessna Public Relations. Our gross weight at takeoff with 110 gallons of fuel and 200 pounds of optional equipment was 4,704 pounds.

CESSNA 320 SKYKNIGHT

Performance: at gross weight of 4,990 pounds	
Speed:	
Maximum at critical altitude (16,000 feet)	265 mph
Maximum recommended cruise 75% power @ 19,500 ft.)	245 mph
Range:	
Maximum recommended cruise 75% power @ 19,500 ft. 100 gallons, no reserve	864 miles at 247 mph
Maximum recommended cruise, 75% power @ 19,500 ft. 130 gallons, no reserve	1,136 miles at 247 mph
Rate of climb at sea level:	
Twin engine	2,250 fpm
Single engine	620 fpm
Service ceiling:	
Twin engine	28,700 ft.
Single engine	20,800 ft.
Specifications:	
Span	36 ft.
Length	29 ft. 6 in.
Weight empty	3,190 lbs.
Gross weight	4,990 lbs.
Fuel capacity:	
Standard	102 gal.
Optional	132 gal.
Baggage	200 lbs.

Acceleration during the takeoff roll with flaps retracted was smooth and rapid. The maximum allowable 35-inch hg manifold pressure (mp) is maintained at all climactic conditions by the automatic waste gate controller of the turbo-supercharger but should be checked by eye for malfunction once the throttles are full forward.

At a rotation speed of 93 mph with approximately 1,200 feet of runway consumed we broke ground. Skyknight's minimum single engine control speed is 88 mph.

With gear retracted, acceleration increased, putting us past the best single-engine climb speed of 119 mph in a matter of seconds. Power was adjusted to 29 inches mp and 2,450 rpm (75 per cent power) and a cruising climb altitude was established to hold 140 mph IAS. Initial rate of climb was slightly better than 1,500 fpm.

Once trimmed to the desired attitude the aerodynamically clean Skyknight requires very little manual adjustment.

As altitude increased, the throttles were maintained at 30 inches mp. Mixture is leaned handily through coordinated use of the mixture controls and the fuel flow gage. The gage dial is marked with arc segments corresponding to the proper fuel flow for various power settings. With the gage engine needles synchronized, the pilot knows that he is using best power mixture while gaining an accurate approximation of his fuel consumption. Engine surge acts as a reminder to readjust mixture.

Going through 10,000 feet, oxygen masks were donned since cabin pressurization is not a part of the Skyknight's equipment.

Outside air pressure, however, is not a

(Continued on page 124)

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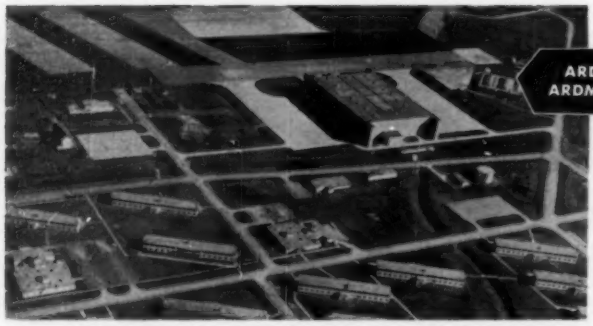

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(Continued from page 123)

factor to the engines since the turbosupercharger uses engine exhaust and ram air to drive the compressor turbine in the induction system. This allows constant pressure to be maintained in the engine from sea level to its standard day critical altitude of 16,000 feet.

In checking through the Skyknight Owner's Manual, critical altitude can be readily ascertained through temperature interpolation with the altitude charts. Since our temperature was well above standard, our book critical altitude was lowered to 13,750 feet. However, the turbosupercharger performance exceeded the specifications.

At 19,000 feet, while maintaining 130 mph IAS, rate of climb was a strong 500 fpm. Above 19,000 the rate of climb dropped off sharply and airspeed had to be reduced to 125 mph IAS to maintain a 250 fpm climb to 21,000 feet.

At 19,000 feet the temperature was 36 degrees F above standard. A cruise run gave us a TAS of 225 mph exceeding the aircraft specifications for the day by three mph.

Due to the temperature, optimum altitude was reduced and best cruise results were obtained in the 15,000 foot range. With 27 inches mp available on the left engine, 28 inches mp on the right, and 2,450 rpm, 70 per cent power gave a TAS of 241 mph at 15,300 feet.

At 15,000 feet using 77 per cent power, 247 mph TAS was held. These speeds were seven to 13 mph above the book figures. Pilots used to 310 flying will be surprised by the comparatively small amount of forward elevator trim required in the Skyknight to maintain cruise altitude. This is due to the three and a half inch height increase of the cabin and empennage.

A shallow dive from 17,000 to 16,000 feet was used to check the aircraft close to its 265 mph maximum speed. At 261 mph a very slight vibration was felt through the airframe and controls. Further acceleration did not aggravate this condition. Controllability remained unaffected.

The stall characteristics of the 320 are excellent and power-on stalls must be induced since the extremely nose-high stall altitude proved to be well beyond that encountered during normal maneuvering.

From a normal cruise condition at 15,000 feet in clean configuration power was reduced to 15 inches mp.

To dissipate airspeed the nose was pulled up sharply and held. At 90 mph IAS the stall warning horn sounded and at 87 mph IAS the first mild aerodynamic buffet was felt. Buffeting increased as the back pressure was held. At approximately 81 mph IAS the aircraft fell through the stall and lost altitude. At no time was the stall violent, nor was there any difficulty in controlling the slight longitudinal oscillation that begins below 83 mph IAS. Aileron control was an aid in keeping the wings level after the elevator and rudder became almost ineffective. This is due to the amount of air that is channeled around the aileron surfaces by the fuel tip tanks.

With gear extended and 45 degrees of flap, the horn sounded at 83 mph IAS, but the first buffet did not occur until 66 mph IAS. At 62 mph IAS the nose finally pitched

down in a "loss of lift" break. Releasing the back pressure, cleaning up the aircraft and adding cruise power ended the stall portion of the evaluation. At no time did either wing show a tendency to drop out.

At 15,000 feet in cruise, power to the right engine was cut and the Hartzell constant speed propeller was feathered.

Handling ease was the key here. The amount of left rudder necessary to maintain balanced flight was not excessive and was trimmed out quickly. Turns of 120 degrees to the left and right using 30 degrees of bank were accomplished hands-off once the proper trim was applied. Single-engine stalls proved no problem.

Altitude was held at 14,700 feet at an IAS of 103 mph and single-engine climb from 13,700 feet was 280 fpm.

Restarting the engine at altitude pointed up a large plus for Cessna's anti-congealing oil radiators. A small portion of warm oil is automatically utilized by the engine until a temperature rise opens the valve for the remaining oil to proceed into normal lubrication. This allowed rapid warm-up.

For letdown, best results were obtained with lower airspeeds and flaps or a combination of gear and flaps and 135 mph. Cowl flap adjustment is necessary to regulate engine heat during descent.

Landing the Skyknight poses no unique situation and the best approach speed is 95 mph IAS with 15 degrees of flaps, landing gear extended.

At the field boundary full flaps were utilized and airspeed slowed to 90 mph.

As with the 310, the high-speed wing on the Skyknight makes it desirable to carry a little power in the flare to avoid having the aircraft drop suddenly.

Once down, immediate flap retraction (electric flap actuator has a four-second reaction time for full up or down) puts the aircraft's full weight on the wheels, and the large brakes can bring you to a stop with a surprisingly short roll-out.

In looking at the Skyknight from an engineering point of view, the turbosupercharger offers a number of items to operational advantage. In being a separate unit aft of the engine, maintenance is simplified. Removal for overhaul does not require work with the engine, and routine maintenance is accomplished easily by removal of the aft portion of the upper engine cowling.

The engines themselves boast better performance through fuel injection. The engine exhaust system employs a new expansion bellows system and aids in preventing exhaust cracking problems and thereby gives longer life with less maintenance.

The all-metal Skyknight is of semi-monocoque construction and is built for the stress of rugged weather.

Since the above-the-weather principle includes all-weather operations, desirable optional equipment includes wing de-icer boots and electric anti-icing for the propellers. These items combined with Cessna's many built-in dual features will couple the enjoyment of Skyknight performance with the safety that instrument flying warrants.

The impression that the model 320 left on this pilot was one of high-altitude excellence. It has the range and speed to help open these upper regions to a new light twin generation of business aviators. END

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INDIANA TECHNICAL COLLEGE

Air Transportation

(Continued from page 57)

and mail have increased from 70,000 pounds ten years ago to nearly two million for this year.

J. Walker Owens, general manager of the Chemung County Industrial Development Board, admires the excellent industrial history of Elmira since the turn of the century. "However," he says, "since World War II, shifting markets, acceleration of industrial deployment away from established industrial marketing centers has had a disturbing effect upon our surrounding communities." Old reliable products gradually faded away and new products utilizing new materials and methods did not join the industrial family to offset the attrition.

Meanwhile, just 18 miles to the northwest, Corning's giant glass works, situated across the line in Steuben County, blossomed and grew. Its glass products infiltrated into many new lines, became the primary or secondary material for thousands of items covering household wear to missiles and spacecraft. Here too, Ingersoll-Rand was finding its markets changed, its products facing stiffer competition.

Corning Glass Works growth plans spread into a network of 17 plants located from Rhode Island to Oklahoma; Michigan to North Carolina. Its management task became vastly complex while rail and highway facilities involved heavy lost-time penalties for executives. Faster communications and transportation became the number one priority to Elmira-Corning.

Nearby Binghamton, already on the high frequency air routes, began to lure passengers from Elmira. A two-hour auto drive to the airport and a one-hour flight to New York City were more acceptable than n overnight trip by train. Elmira-Corning businessmen found it harder and harder to get buyers and industrialists to visit their plants.

Walker Owens said, "It was around 1956 and 1957 that a few courageous men from the city and county decided to do something about our problem. They formed the Industrial Development Board, and that's when I came into the scene."

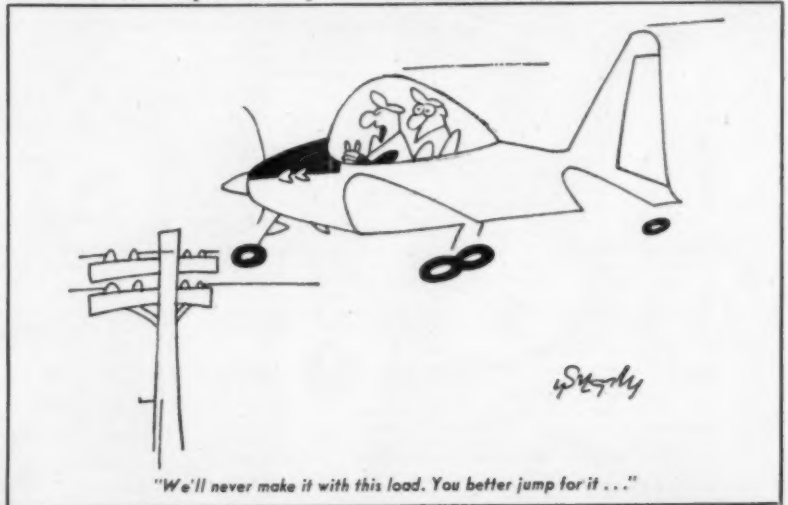
The immediate offspring of this body was a serious desire to improve the airport and air transporation. The group rated this number one in building a healthy existing industry and setting the proper climate for new ones to come.

Elmira and Chemung County can hardly be considered youngsters in aviation. Elmira is known the world over as the sailplane capital of the USA. It was one of the first cities to be selected for an emergency landing field when air mail service was started between New York and Buffalo in 1929. The rotating beacon at Elmira's grass-covered strip has long been a familiar signpost of the air to those who fly.

But despite this early activity, Chemung County Airport, positioned mid-way between Elmira and Corning, did not progress. The community looked upon it and pilots with an air of tolerance for those foolish "airplane fellers" who spent Sunday afternoon puttering about the skies. After all, wasn't Elmira a rail center? Why did it need airplanes?

This attitude prevailed through the late thirties when American Airlines tri-motored Stinsons made passenger and mail stops, and after World War II when the airport was turned over to the county by the Air Force. American Airlines continued stops for a time, then Pennsylvania Central Airlines (later Capital and now United) and Robinson Airlines (now Mohawk) began to serve the area. The same building used during the early 30's for fixed-base operations had its walls bulging serving postwar air travelers. According to a leading citizen the field had a "whistle-stop appearance, and many of us were wishing a tornado would blow it away. We were ashamed of our hick town appearance to people passing through or getting off the airplanes."

In 1957, the county and IDB asked Leigh Fisher, a nationally recognized economic planner, to tackle the problem of planning Chemung County's requirements. This was the start of the new look ahead that produced a modern airport, 5,000-foot runways, a new terminal building and a $1,000,000 community concept that has now begun to pay off in terms of industrial and economic benefits. Fisher's plan covered more than 200 printed pages and cost the board $7,500—but it was worth it. Through the plan, the county's leaders added know-how to courage and pressed



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ahead on a pay-as-you-go program.

By 1959, the new terminal building was completed. Taxiways, parking lots, and service facilities were ready and working. At the same time, Mohawk Airlines had grown into maturity as an important aerial bridge to 47 communities in the northeast. Its airplanes were being modernized, and 14 flights a day were adding flexibility and reliable schedules for the Elmira-Corning business family.

Capital's flights remained the same, two trips each way per day. But Mohawk obviously was becoming the backbone for aerial communications service. Today, Mohawk's Convair 440s land and take off 24 times a day, placing the nation's cities at the county's front door. Elmira-Corning today has more market opportunities and business flexibility than suburban areas close to New York City, areas which are considered to be at the core of world-wide transport.

A Corning Glass Works executive can step into a Mohawk Golden Convair at Chemung County Airport and be in his New York office in the same time it takes an executive to step into his car at Huntington, Long Island, and reach the same mid-Manhattan area. In addition, the Corning Glass traveler has Cleveland, Buffalo, Pittsburgh, Albany, Boston, Philadelphia and, soon, Washington as equally convenient flight destinations, just a day's business trip away. St. Louis via Cleveland and a jet is less than three hours away.

This is the gold mine of travel advantage Chemung County's airport offers to Elmira-Corning. What then do the citizens and the users think about this major achievement and $1,000,000 investment?

Amory Houghton Jr., president of Corning Glass Works, whose ultra-modern glass office building stands majestically among this pioneer industry's ancient buildings, was a logical person to ask. "The main offices of Corning Glass Works are at Corning because our business started here," he said. "As our company continues to grow, we depend greatly upon expansion of airline service, especially that of feeder lines, to permit us to reach with greater ease the many plants and offices, not only of our company, but also of our customers."

John E. Merz, Corning traffic manager, reports executive air travel amounting to more than $450,000 annually. This is approximately 90 per cent of all authorized business travel. Overall passenger business generated by Corning's operations exceeds $500,000.

George W. Douglas, Sales Manager, Corning Lamp Department, says, "I feel as though all of that travel is mine. I live on airplanes." Where Douglas used to spend two nights and a day away from the office for a day's business in New York City, 230 highway miles away, he can now leave Chemung County airport on an early morning flight and be back that evening for a late dinner. He considers air transportation absolutely essential to his sales work for Corning.

Ronald L. Dann said some things Corning executives could not comment upon officially. He believes good air transportation is the reason Corning decided to build a $15,000,000 Research Center on 450

(Continued on page 128)

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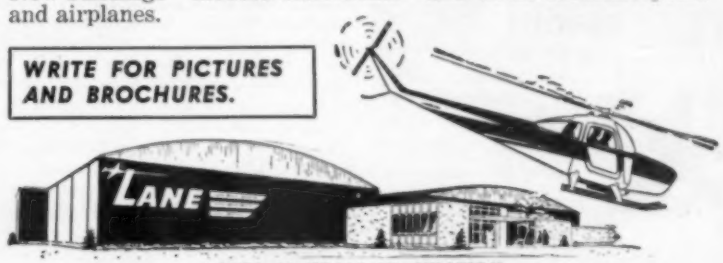

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(Continued from page 127)

acres of land at Erwin, a suburb of Corning.

"And, because of this, we are building a $1,500,000 motel, a $2 million shopping center, planning for 750 homes and one million dollars in apartments." Dann continued, "If that isn't a good example of what airlines mean to this area, then we'd better stop trying."

In Elmira, Remington-Rand officials echoed and endorsed Corning Glass executive opinions. In fact, Elmira officials believe improved air transportation was an important factor in the typewriter company's decision to keep the plant in the community. Rem-Rand salesmen say reliable air transportation is a must for them to stay competitive.

In all, the tour developed these answers:

- Much of the public is uninformed about their airport. Most complain that the railroads are treated unfairly, that planes and trucks get the breaks.
- The few who do know about the airport and the airlines service there have little knowledge of what it means to the area economically. Most assume that it is responsible for their "taxes being too high" even though the tax rate has changed only three cents in ten years.
- Railroads have been and still are important factors in Elmira's industrial health and area economy. Persons questioned on the street feel that a grave injustice is being done the railroads, whereas they evidence no concern for the health of the airlines.

Much needs to be done in informing the community about Chemung County operations. John Gridley, chairman of the Chemung County Board of Supervisors, has a public information program at the top of his "must-do" list. He's proud of the airport and its financial condition operating within a $93,000 budget. There is no bonded indebtedness and the County built the terminal from out of pocket funds. But that is not enough.

"We have long needed an educational program," Gridley said. "When people discover how management must go to work and capitalize on our assets, I'm betting we'll come up with the most forward-thinking community in the country."

Paul Schweizer, vice president of Schweizer Aircraft Company, located at the edge of the airport, supports Gridley's views. "The average citizen does not yet know what we have here," he said. Schweizer and his brothers have built a $2,500,000 business that employs 300 people and brings thousands of visitors to the area annually to take part in sailplane activities. The world-renowned soaring site, atop the ridge at Harris Hill, soon will be developed into a community center.

On my way back to New York City aboard Mohawk's Golden Convair, I felt the Elmira story was a living example of air transportation opening new markets and business opportunities to an old community —one that is shaking off old habits and helping itself. But the story also underscored what we already know but too often forget: the urgent need for airmen to stop being concerned only with the "nuts and bolts" of aviation, and apply themselves to the task of selling the public on the economics and proper utilization of air transportation. END

FLYING CALENDAR

October 1—Quanah Air Show, Quanah, Texas.

October 3-5—National Airports Conference, University of Oklahoma, Norman, Okla.

October 4—Pacific Regional Meeting, International Airline Navigators Council. Day session: Hotel Drake Wiltshire, Stockton Street, San Francisco, California. Evening session site to be announced.

October 4-6—National Association of Air Traffic Specialists; First Annual Meeting, Oklahoma City, Okla.

October 5-9—Florida Aero Club Fifth Annual Air Cruise to Nassau and West End, B.W.I. Depart and return Ft. Lauderdale. Contact Cruise Director Harry B. Collins, 375 N.E. 154th St., North Miami Beach 62, Florida.

October 6-7—Sixth Annual Michigan SMALL Race, Jackson, Michigan. Sponsored by Michigan Chapter of Ninety-Nines.

October 7-14—Thirteenth Annual All-Texas Air Tour. Contact Asa Burroughs, 307 Walton Building, Austin, Texas.

October 8—Fly-In and Annual Chicken Barbeque and Color Tour, Antrim County Airport, Bellaire, Michigan. Contact Dianne Ritt, Antrim County Airport, Box 371, Bellaire, Mich.

October 8-10—Twenty-Fifth Annual Convention, International Northwest Aviation Council. Davenport Hotel, Spokane, Washington.

October 9-15—American Rocket Society Space Flight Report To The Nation. New York Coliseum, New York City.

October 13-15—Canadian Owners and Pilots Association Seventh Annual Convention. The Sands Inn, Muskoka Lake, Ontario, Canada.

October 14—Fifth Annual Civil Air Patrol Cruise and Proficiency Meet; San Carlos Airport, San Carlos Airport, California.

October 14-15—Aerospace Exposition, sponsored by Missouri Civil Air Patrol. Rosecrans Field, St. Joseph, Missouri.

October 15-18—Cessna Aircraft Company Annual International Sales Meeting, Wichita, Kansas.

October 19—General Aviation Safety Committee, National Safety Council, Conrad Hilton Hotel, Chicago, Illinois.

October 23-24—Canadian Aeronautical Institute and Institute of the Aerospace Sciences joint meeting, Ottawa, Canada.

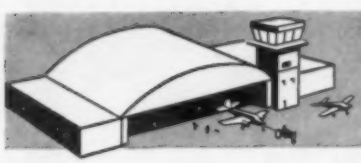
October 23-27—International Air Transport Association 17th Annual General Meeting; Sydney, Australia.

October 26-27—Association of Local Transport Airlines Quarterly Regional Meeting. Sahara Hotel, Las Vegas, Nevada.

October 30-November 1—Sixth Annual Air Traffic Control Meeting; Deauville Hotel, Miami Beach, Florida.

November 1-3—Connecticut General Flight Forum Symposium, Hartford, Connecticut. Subject: "The Issues and Challenges of Air Transportation."

Calendar items must be received by FLYING's editorial office, 1 Park Avenue, New York 16, N. Y., two months prior to the event.



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BRIEFINGS...

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non-occupant fatalities resulting from accidents involving (1) automobiles-taxis, (2) railroad passenger trains, (3) buses; and those resulting from (4) domestic air carrier and (5) general aviation aircraft crashes, during the previous 11 years, 1950-1960. The record, as first made public by Bakke at recent National Pilots Assn. Forum at Westchester County Airport, N. Y.: Automobiles, 99,440 deaths; railroad passenger trains, 11,032; buses, 4,770; domestic air carrier aircraft, 33; general aviation aircraft, approximately 25.

In a space craft built-for-three, three scientists of General Dynamics/Astronautics, San Diego, demonstrate in a MARS space station model the position a crew would assume during launch of the proposed orbiting laboratory and upon the vehicle's re-entry into the earth's atmosphere. The

scientists are viewed downward through a hatch showing the "astronauts" on their backs in a crew compartment at bottom of the three-story space station. The experimental couches are of tubular metal, laced with nylon cord.

Alaska Airlines has been appointed dealer in the States of Washington and Alaska for the LASA 60 bush transport aircraft. An order for five of the six-place utility aircraft has been placed with Lockheed International by the airline which plans to use the aircraft in several of its widely diversified operations in the 49th State and Pacific Northwest, as well as for demonstration purposes.

Publication of a comprehensive guide to the building, layout, or expansion of an airport has been announced by FAA. The new manual, "Airport Design" stresses current technological factors which contribute to safety and usefulness of airports. It is well illustrated and is prepared with plastic binder rings so that supplemental information, mailed automatically to all subscribers, may be added as needed. Price, including future supplements, $2.50; from the U. S. Government Printing Office, Washington 25, D. C.

An audio-visual ground training program for pilots is being offered by Aviation Industry Relations Co. (AIRCO) a new Chicago firm with offices at 155 E. Ohio St. The firm also offers sales promotion and sales training aids for manufacturers within the general aviation industry. AIRCO's initial program for student and private pilots includes CARs; facts of flight; meteorology; visual navigation; radio communications and navigation; typical cross-country flight; and preparation for FAA written examinations. The complete package is $375.

Acquisition of all assets of the National Aero Service Co., specialized aircraft service facility at Midway Airport, Chicago, has been announced by Butler Aviation. The acquisition brings a total of some 125,000 square feet of maintenance, hangar and service space to Butler's Midway base. The combined operation is under the direction of Butler's Midway manager John Stedman.

"Price Guide," the little Blue Book of Aviation, recognized authoritative source of used airplane prices, has been acquired by the Aircraft Acceptance Corp., of 4920 E. 5th Ave., Columbus 19, O. Now published in Columbus, "Price Guide" for many years had been published by the late Harry Shaffer, president of Interstate Aircredit Corp., in Minneapolis, Minn. George S. Hoster Jr., president of Aircraft Acceptance, a wholly owned subsidiary of Interstate, states the Guide will retain its objective approach and only changes that will further enhance its value to the industry will be incorporated.

Three government agencies—Department of Defense; National Aeronautics and Space Administration and the FAA—are agreed that a commercial airplane with speed three times that of sound is feasible and that the airplane could be ready by 1970-1971. This is the major conclusion of a booklet "Commercial Supersonic Transport Aircraft" a 50-page report prepared by the three agencies as a joint review of information gathered from industry and government sources. Production cost of each airplane is estimated between $12.6 and $20 million and the world market for this type aircraft is estimated by industry to be upwards of 200.

Reaching more than 250 feet above the Mojave desert, the free world's largest rocket engine test stand nears completion at Edwards Rocket Site, Calif. It will test 1.5 million-pound-thrust F-1 rocket engine under development by Rocketdyne, a division of North American Aviation, Inc., for

the National Aeronautics and Space Administration. The $15 million NASA complex, on a 180-acre site on Leuhman Ridge, includes three huge test stands, concrete underground control center and related facilities. The tanks atop the test stand provide propellants for testing.

Andrew J. Smith of Tecumseh, Mich., flying a German-made LO 150 Sailplane won the 28th National Soaring Contest held at Wichita, Kansas from August 1 through 10. Second place went to William Ivans of San Diego, Calif., who flew a British Skylark 3D. Third was Rudolph Alleman of Richland, Wash., in a German Ka-6. Paul Bikle, president of the Soaring Society of America and holder of world's absolute altitude record for sailplanes of 46,000 feet, took fourth place in the U.S.-built Prue Standard.

Mountain Airport—In the heart of a scenic upland valley, backdropped on the West by the majestic Teton Mountains, the new Jackson's Hole (Wyo.) Airport is the airman's gateway to one of this country's most generously endowed year-round vacation and recreational areas —for fishing, hunting, skiing, trail hiking and camping—you name it. Located eight miles north of Jackson, the airport offers a 6,300-foot NW/SW, paved and lighted runway, ample ground facilities and 80/130 oct. avgas. Cab service is available into town, where skiers will find the mile-high ski lift to Snow King Mountain. Frontier Airlines serves Jackson daily.

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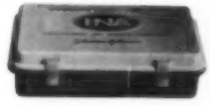

Name_____

Street_____ City_____ State_____

My plane is_____

My insurance agent's name_____

Agent's address_____

City_____ State_____

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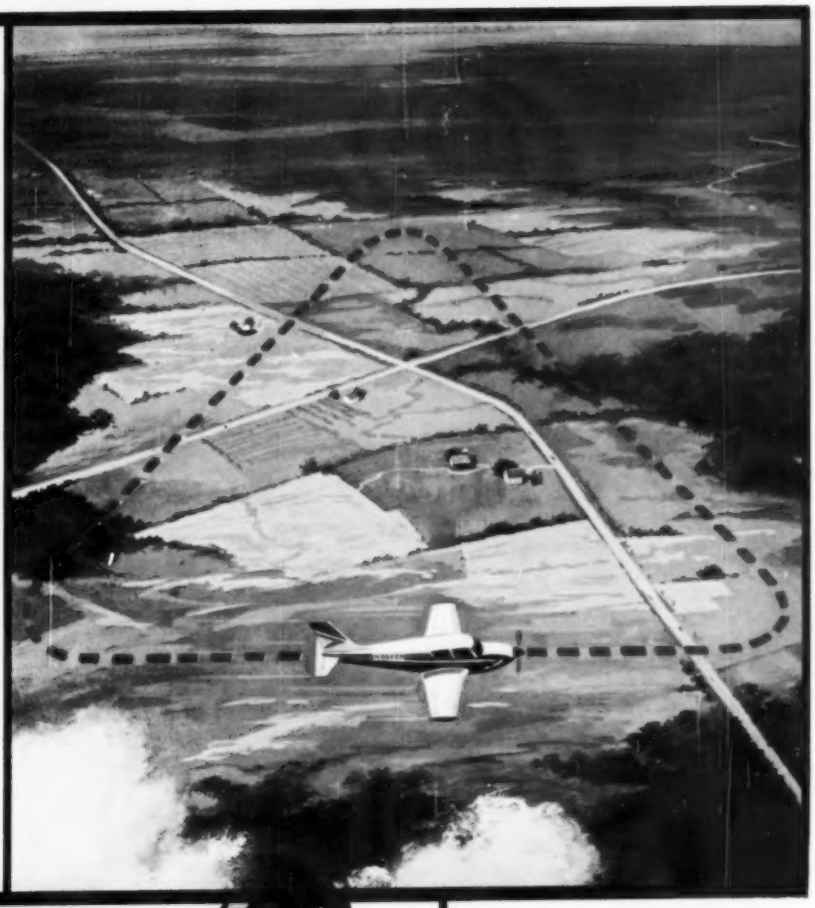

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